A WINDOW OPEN ON THE WORLD

The UNESCO Courier

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from the ashes of war

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JULY-AUGUST
1959
(12th year)

IS THE OCEAN IN DANGER?

(See page 28)

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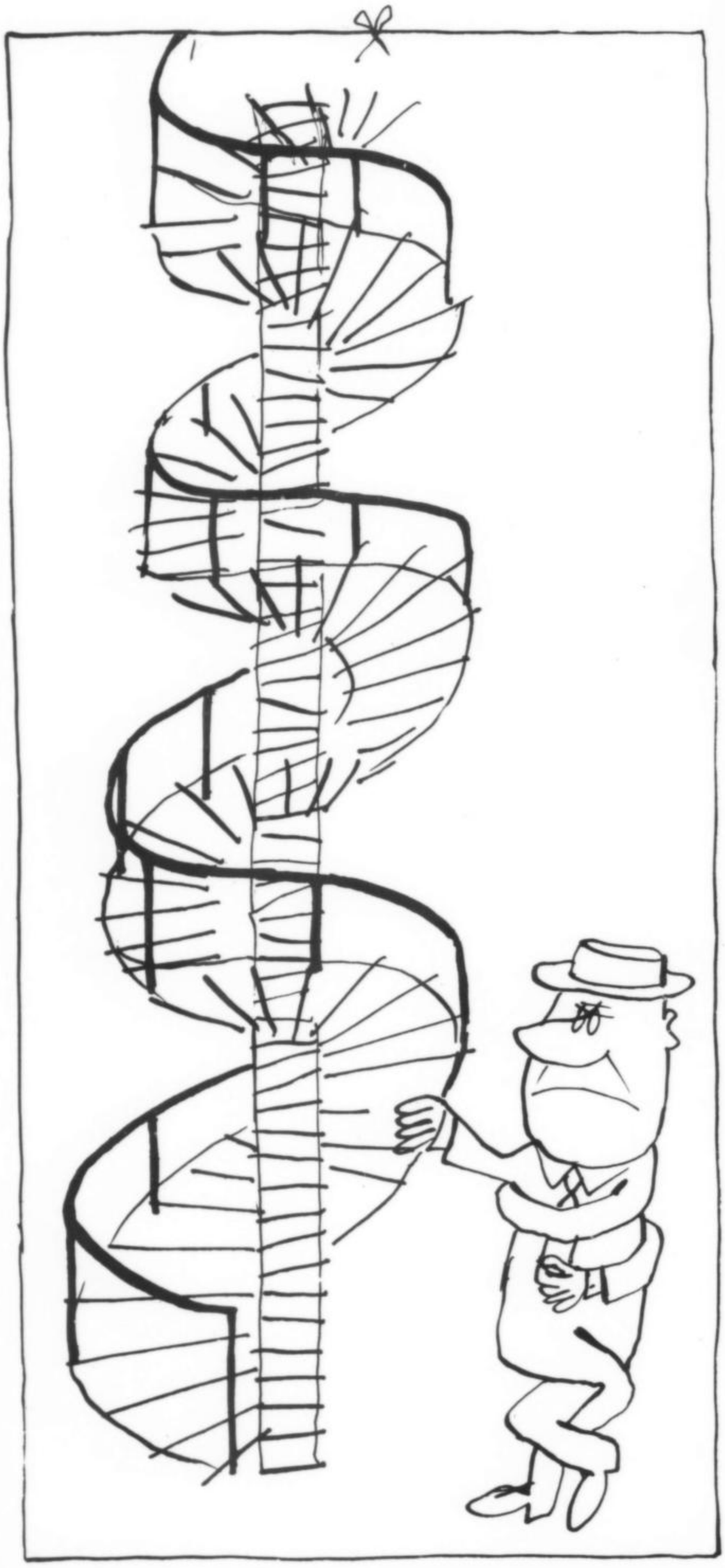

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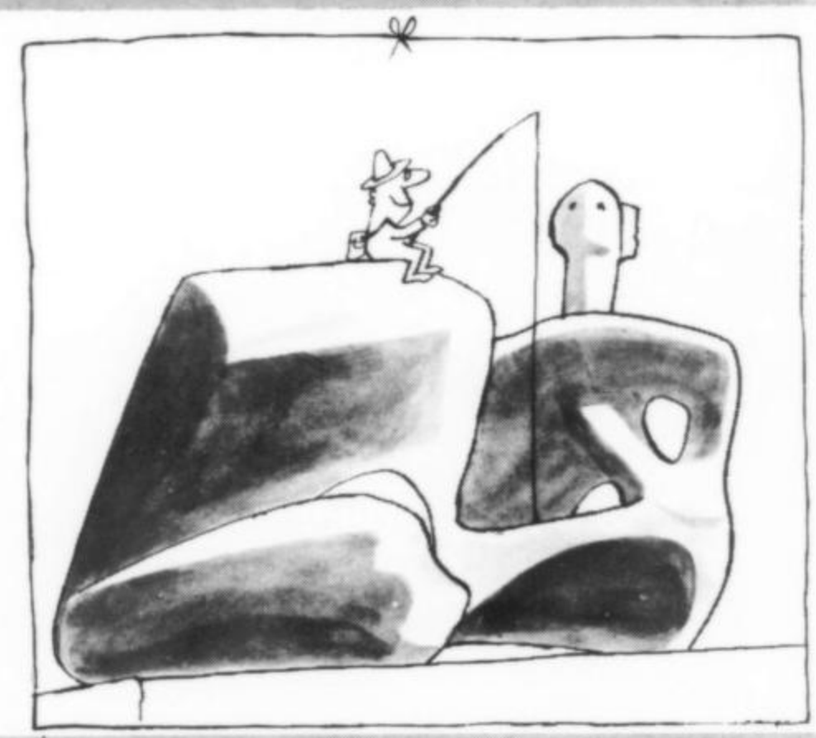

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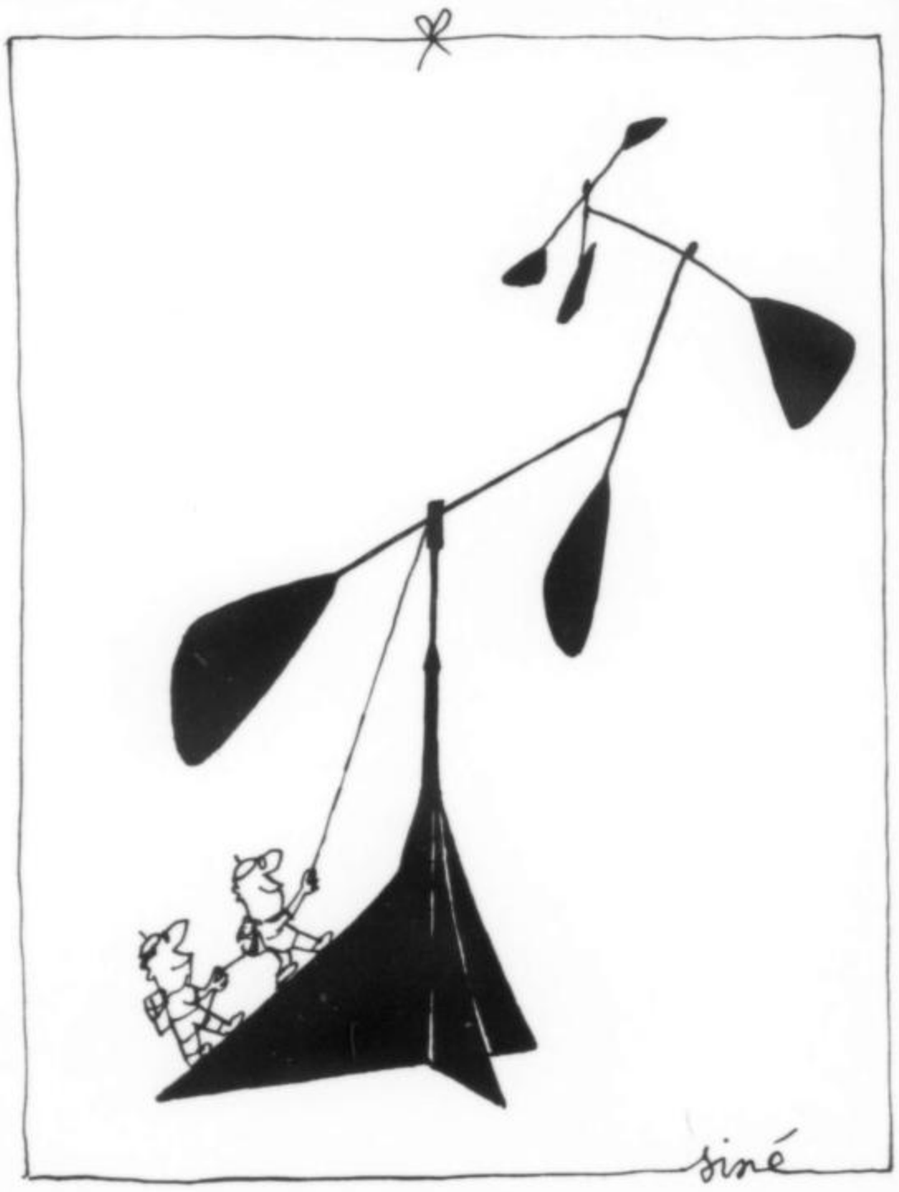

CALDER'S MOBILE

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COVER PHOTO

In May 1940, a devastating bombardment transformed Rotterdam into a sea of flames which burned for 40 days and 40 nights and left 6,000 million cubic feet of rubble to be cleared away. Today Rotterdam is one of the world's most imposing cities. This is the "miracle" of Rotterdam. Striking works of art in the streets and squares, like Zadkine's monument (above) erected to commemorate Rotterdam's ordeal, also serve as symbols of its resurrection.

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PEERING INTO THE MIND OF A CHILD

WHEN does a child start to "think"? At what age can he understand such ideas as length and number? When is he capable of what is called "scientific thought"?

Educators and parents the world over would be extremely interested in knowing the answers to such questions. Today, they are being sought in Switzerland at the Institute for the Sciences of Education in Geneva. The Institute was founded in 1912 and attached to the University of Geneva in 1929, but its origins go even further back. In 1901, at the dawn of the new century, the Medical Society of Geneva heard a daring proposal by Edouard Claparède, the future co-founder of the Institute along with Pierre Bovet. Claparède called for nothing less than a school "made to measure" for children. Into his startled audience, he dropped this bombshell: "We now pay more attention to children's feet than we do to their minds."

Five years later, Claparède was to state: "It is just as important for the educator to know the laws of the mind and its growth as it is for the horticulturist to know the biology of plants or the doctor to know the physiology of organs." It was on this principle that the Institute started a laboratory in which experimental psychology is applied to education. For the past thirty years, both at Geneva and at Neuchatel, this work has been carried on by Prof. Jean Piaget, a leading figure in psychological research which has a bearing on education.

Prof. Piaget's studies had previously shown that the development of a child's thought processes can be compared to a ladder. The child goes from one step or level to another. At each level, corresponding to a certain age, there is an equilibrium in his thinking.

Then, two years ago, a special section of the Institute was created to study how the child passes from one stage to another. This study, directed by Dr. Bärbel Inhelder, professor at the Institute of Child Psychology, and Dr. Gerald Noelting, is based upon a long-term experiment. Twenty children, divided into four age groups, have been selected from Geneva schools for study. They come from all social classes, have average intelligence test ratings and have experienced no special difficulties in school.

They have it all taped

SOME fifty tests based on special observation techniques developed by Prof. Piaget over the years are used with these children. In addition, the research workers have at their disposal an experimental psychology laboratory set up by the state of Geneva and provided with ultra-modern equipment through a grant from an American foundation.

In this laboratory, each conversation between the scientist and a child is recorded on tape. At key points in the interview, a motion picture camera comes into play. The result is that the Institute has been able to "produce" records and a film on each child, showing the changes in his social behaviour and the way his mind works at various

WHO photos by Eric Schwab

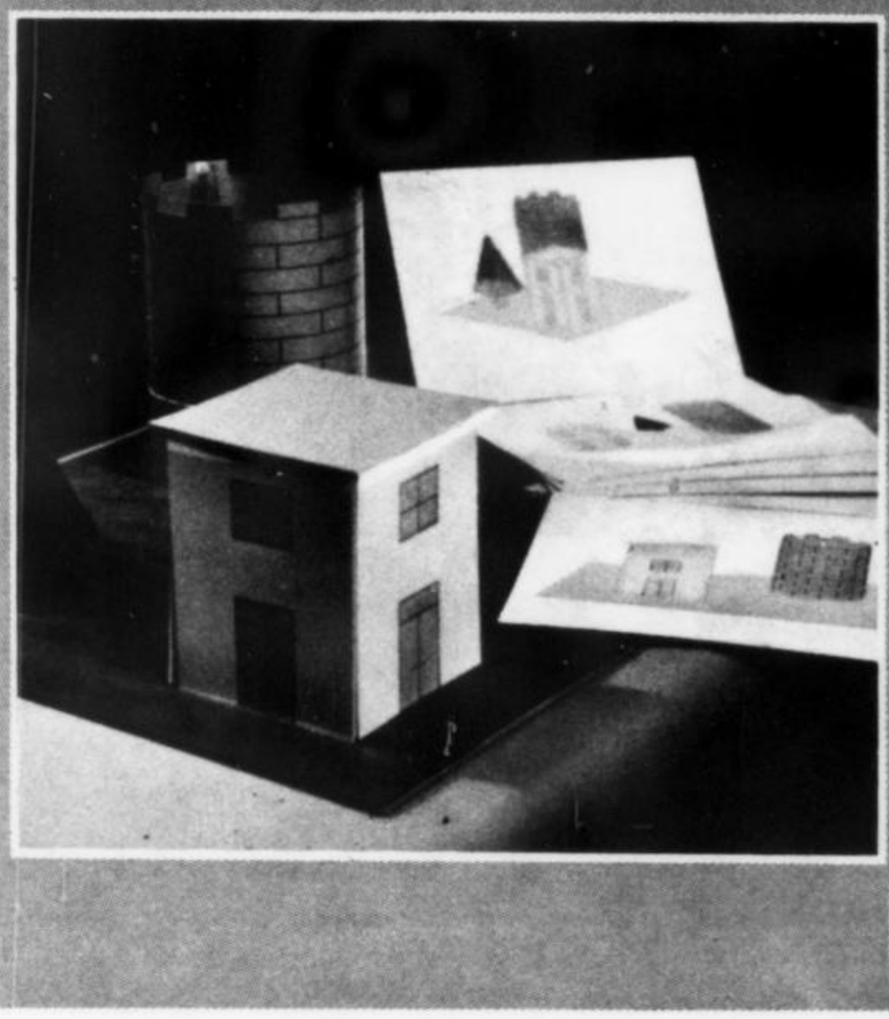
HOW DO YOU THINK I SEE THIS LANDSCAPE? An educational researcher puts the above question to a child who must select the drawing corresponding to what she believes the experimenter sees from his position opposite her (above). Thus she shows her capacity for judging how perspective varies according to the position of the observer. Below, a close-up of experimental equipment used for this test. Using a variety of similar experiments, researchers at the Institute for the Sciences of Education in Geneva study the development of a child's thought processes. Opposite page, the little girl smilingly says goodbye to Institute psychologist.

stages of growth over the years. These experiments have already shown that the child first groups familiar objects or even geometrical elements into "logical classes" between the ages of four and seven. By pouring liquids from one glass to another, for example, he grasps the idea of a quantity which does not vary even if its appearance changes.

He understands concepts of length and number between the ages of five and seven. Weight and volume come later —between nine and twelve—and now the framework of his thought processes has been erected. At the age of ten, he begins to experiment and then, research shows, he is capable of scientific thinking at twelve when he starts formulating theories and searching for proofs.

As is often the case in science, the answers to the first questions have now raised new ones. For example, scientists now wonder if this development is the result of mental and nervous "maturing" or whether it is the fruit of education and just plain practice. Professor Piaget has already shown that external and internal factors always inter-act—that is, you cannot separate them. How this "inter-action" takes place is yet to be answered. There is also an even bigger question: how is the young child's mind, concentrated on the present and on what he can see and touch, transformed into the mind of the adolescent conscious of the world and capable of co-operating with his fellow men?

This is pure research at present, but Prof. Piaget and the Swiss scientists working with him believe that its results may represent a valuable contribution to education.

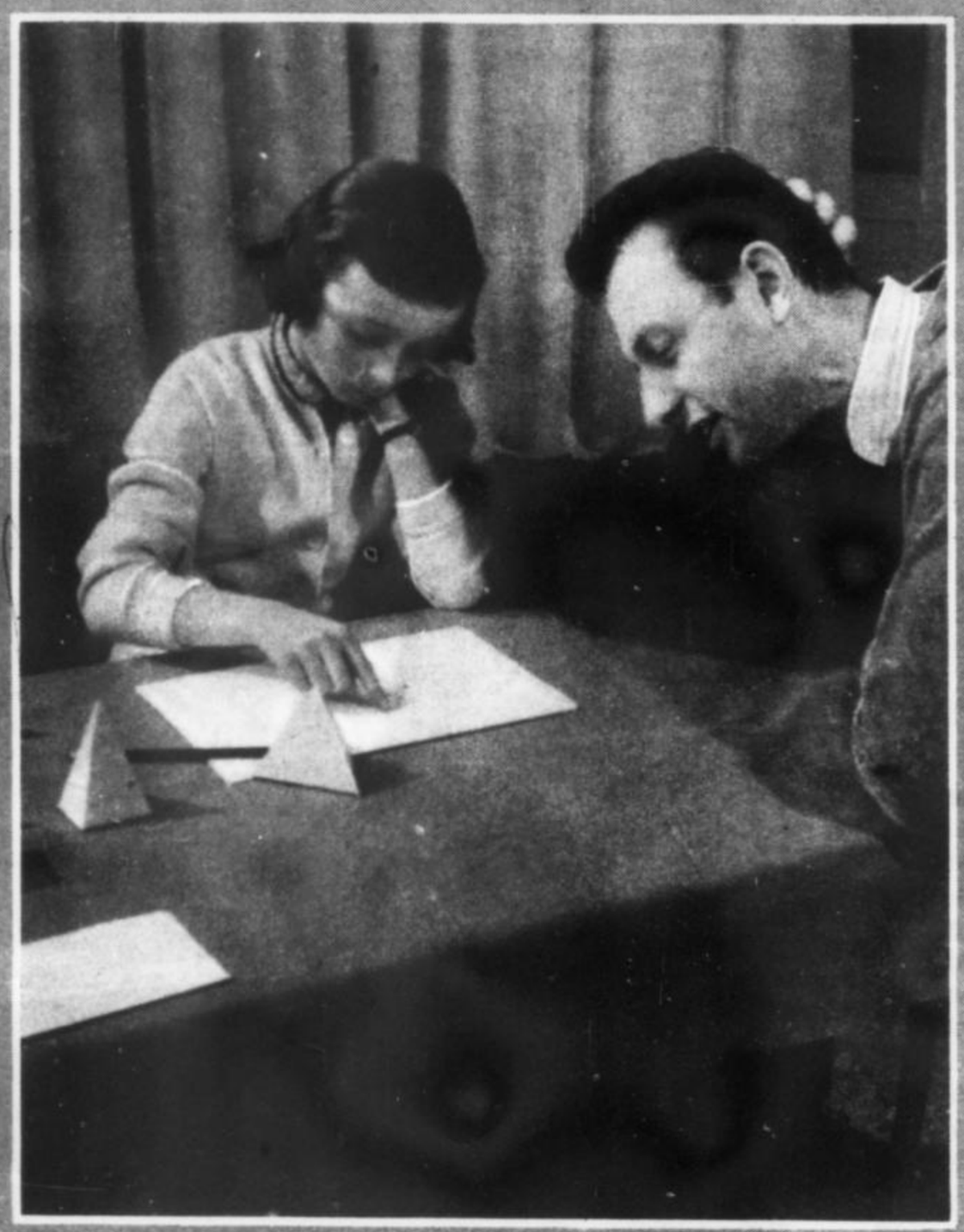


CUBES AND 'COVERED WAGGONS' TEST YOUNGSTERS' THINKING

PROFESSOR JEAN PIAGET, Co-Director of the Institute for the Sciences of Education and Director of the International Bureau of Education, Geneva. Prof. Piaget, who is Swiss, was formerly a member of the Executive Board of Unesco.

We are now paying more attention to children's feet than we do their minds, a famous educator remarked some sixty years ago. Geneva, the Institute of the Sciences of Education has set its sights the child's mind. By direct observation it is trying to find out abo the different stages in children's thinking and how a child passes fr one stage to the other. Some of their techniques are shown her (1 & 2) covered waggon-like apparatus is used to test girl's ability understand the law of falling bodies along an inclined plane. Angle chute (shaft of "covered waggon") is altered and child is asked to jud how far object will fall each time. (3) study of the concept of si The object is to measure the height of a tower standing on a sto The child is asked to build a tower of the same height on the groun (4) the concept of volume. Child must construct houses with ide tical volumes on islands with different surface areas; (5 and representation in two and three dimensions. Child draws on a pl sheet the opened-out surfaces of a geometrical solid she is show

WHO photos by Eric Schw



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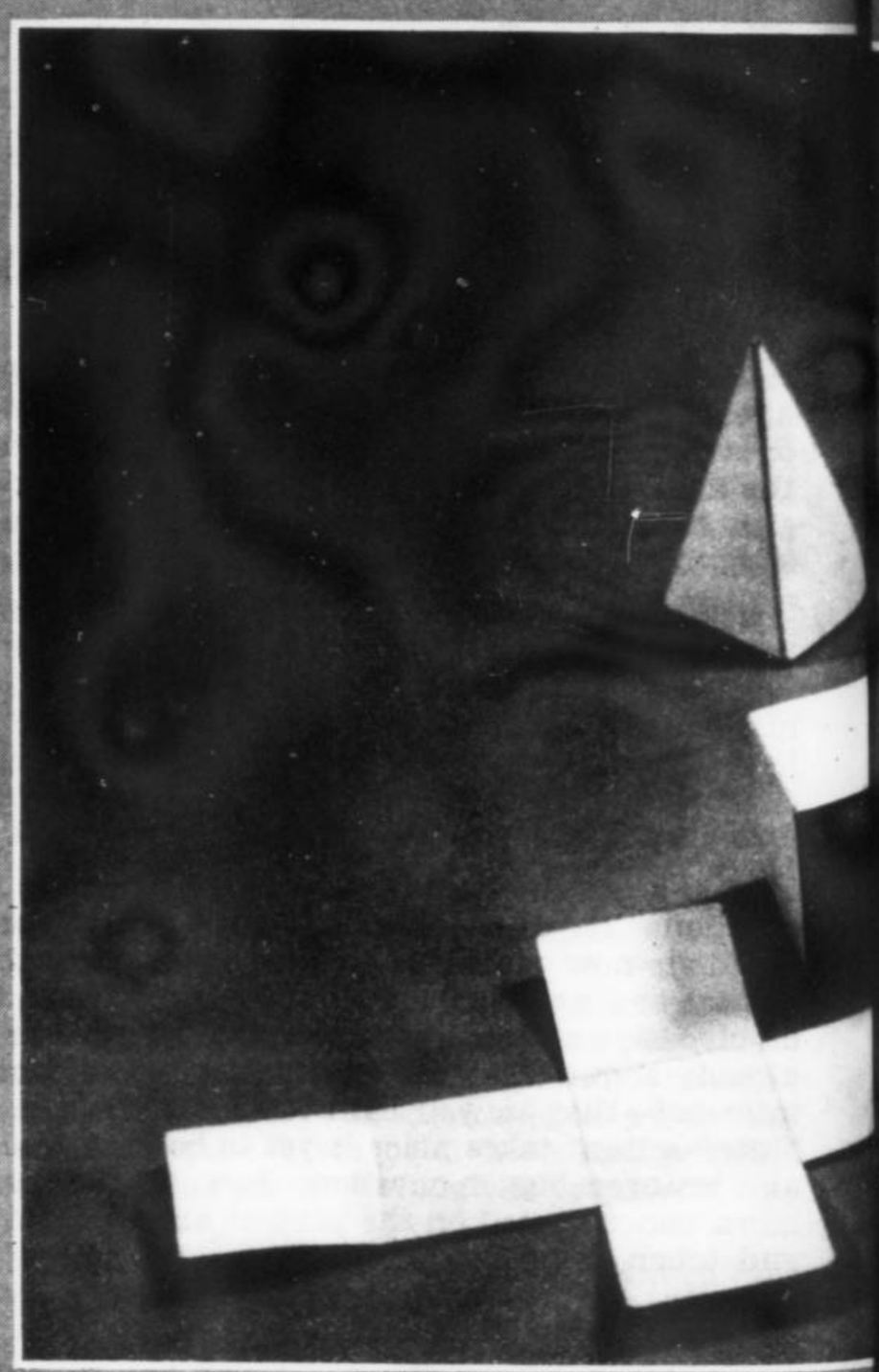

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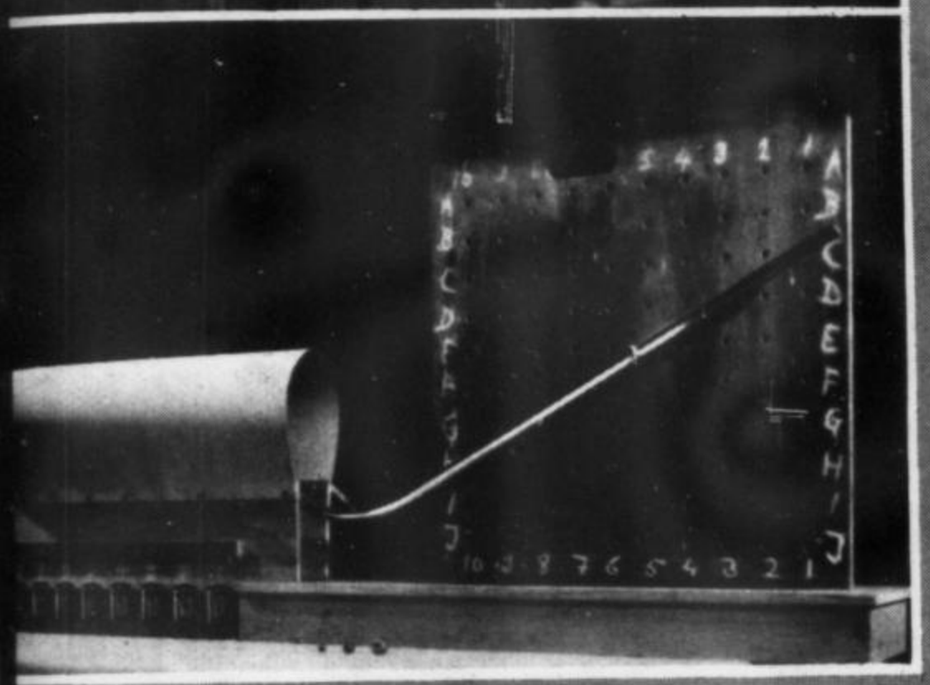

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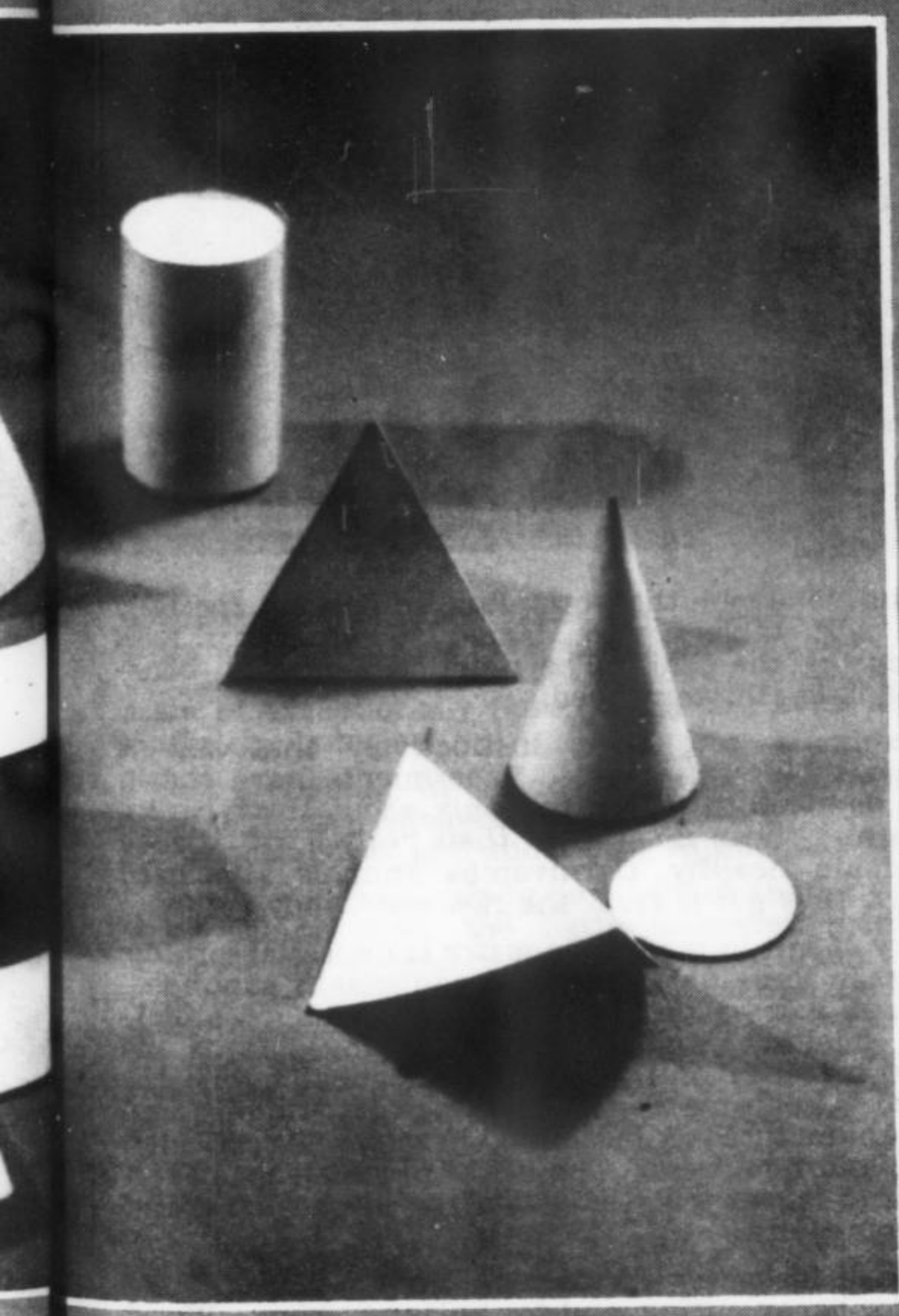

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THE SALT OF LIFE

by Arthur Nettleton
Fellow of the Royal Geographical Society, London

Most people think of salt as being used mostly to season food in the kitchen, but this is one of the least important uses of salt. The largest users of salt are meat and fish packers, chemical industries, hide, textile and leather processors and soap manufacturers. Photo right, shows salt being used for skin curing; below, salt being mined deep underground.

Photos © Imperial Chemical Industries

Of all the substances found in the earth, few are more essential than common salt. If we were to be denied this natural compound the human race would die and much animal life would vanish. Without salt many modern industries would come to a halt.

Centuries ago it was recognized that to deprive a man of his salt was a sure way of causing his lingering death. Few could survive more than a month if subjected to complete salt starvation, and the sentence was a dreadful punishment.

Today medical science is making the reverse approach by investigating the uses of salt in fighting and curing ill health. Doctors are aware that the amount of salt introduced into the human body affects the adrenal glands, and controlling or omitting salt from the diet is a well-known treatment for kidney ailments.

The importance of salt to health has certainly long been known to peoples who dwell in hot climates. Extra salt is needed to replace that lost from the body by profuse perspiration. Heat exhaustion and sunstroke are less likely if this precaution is taken.

Workers in heavy industries such as steel-making who perspire greatly, similarly require to replace their lost salt. Failure to do this is believed to be a cause of muscular cramp, and to avoid that crippling complaint specially flavoured salt tablets were issued to American steel workers during the War. The practice proved so beneficial that it is still continued.

Many animals, too, know instinctively that salt is essential to their well-being. Experiments have shown that dogs deprived of it can live only about three weeks, and cattle and sheep must have their "salt licks" if they are to remain healthy. Carnivorous animals also need salt, though they get it from the raw meat they eat.

The story of salt in modern industry is no less absorbing, and its uses in these fields are being continually expanded. It is used in glass-making, in the production of aluminium, in smelting, and in meat packing. It is the prime raw material of the modern chemical industries, and is used in soap-making, in refining fats and oils, and in the manufacture of bleaching powders, insecticides, fungicides, and fertilizers. The list of processes using salt is legion, and it can truly be called the most versatile of common compounds.

It is needed for water purification, for the manufacture of paper, for bacon curing, and for butter making. World consumption of salt is rapidly increasing, and production is being stepped up to meet the growing demand. Canada

opened a new rock salt mine near Windsor, Ontario, three years ago, and it has been equipped to produce 500 tons a day from a 27ft. seam 700ft. down. Another new salt seam of exceptionally pure quality has been tapped near Goderich, Ontario.

Salt production in Canada alone has trebled during the last 20 years. Altogether we need 20,000,000 tons a year for consumption and industries throughout the world.

Salt was so valuable in early times that it gave us our word salary, from the Latin *salarium*, meaning "salt money"—the allowance given Roman soldiers to buy salt. One of the oldest roads of Italy was called the *Via Salaria* (salt road) because it was the route by which salt was transported. Among the ancients, to "eat salt" with a man was to create a sacred bond of friendship, and this is still so with some Oriental peoples today. In the Middle Ages one's social rank was shown by whether one sat above or below the salt at table. In some parts of the world today salt is regarded as more to be coveted than money. Six pounds of salt was the only reward three Naga hillmen asked for building a church in Burma.

The value placed on this commodity may be gauged from the lengthy treks which take place regularly to the main salt markets. Tibetans descend from the "Roof of the World" to bring back a few pounds of salt, and one of the sights of the Sahara is the annual progression of camel caravans to the salt centre of Timbuktu, the fabulous city which founded its wealth on the salt trade centuries ago.

Salt has promoted learning, too. In its greatest days as a salt mart Timbuktu boasted large libraries, and was a major centre of education.

Agricultural scientists have experimented with salt as a soil dressing during the last 15 years, and much has been learned about its value as a crop improver. Tests have shown that if 3-5 hundredweights of salt are added to an acre of land, sugar beet grown there will yield that much extra sugar. American research has revealed that salt dressings make the beet stronger and more suitable for machine harvesting—an important point in these days of mechanized farming.

Salt refiners have also introduced a variety of salt specially suited to mechanical spreading. It is of uniform cubical structure, so that it passes freely through the spreader, and it does not readily blow from the surface of the soil.

Washing out the soil to make arid arable

On the other hand, salt is far from being a complete boon to agriculture. An excess of this substance in the ground destroys the fertility of the soil, and some of the largest areas of arid land owe their sterility to an overabundance of salt.

Whereas the human body does not demur at one part of salt in each 1,000 parts of water, animals will normally drink a stronger saline solution than this. Most plants do not require much salt. If the soil becomes too salty, it is unsuitable for cultivation.

Lands once fertile have changed into deserts as the rivers irrigating them have impregnated the soil with salt. The water has evaporated and the salt it contained has been left behind, so that in course of time the region has been rendered unsuitable for crops. Research has shown that as much as four tons of salt per acre may accumulate in this way during a single year.

This negative aspect of salt and its uses is now being investigated by agriculturalists, soil scientists, chemists, and botanists. One of their aims is to determine whether projected sources of irrigation water, in areas it is hoped to reclaim for cultivation, are suitable for given crops on the type of soil concerned. Matching the crop to the salinity of the soil will be a vital factor in solving the problems of the world's arid regions, and the successful restoration of agriculture there over a period of time will depend largely on methods of draining off the water used for irrigation and washing soils impregnated with salt.

At the same time efforts are being made to produce varieties of useful plants which will thrive even if the soil

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THE SALT OF LIFE

(Continued)

is unusually salty. Botanists can help by providing plants which do not suffer under such conditions.

As to the sources for industrial salt and agricultural salt, it may be mined in rock form or obtained by evaporating brine from salt lakes or the sea. A third method is to dissolve the deposits of rock salt underground by introducing water through a bore-hole and then pumping this brine to the surface.

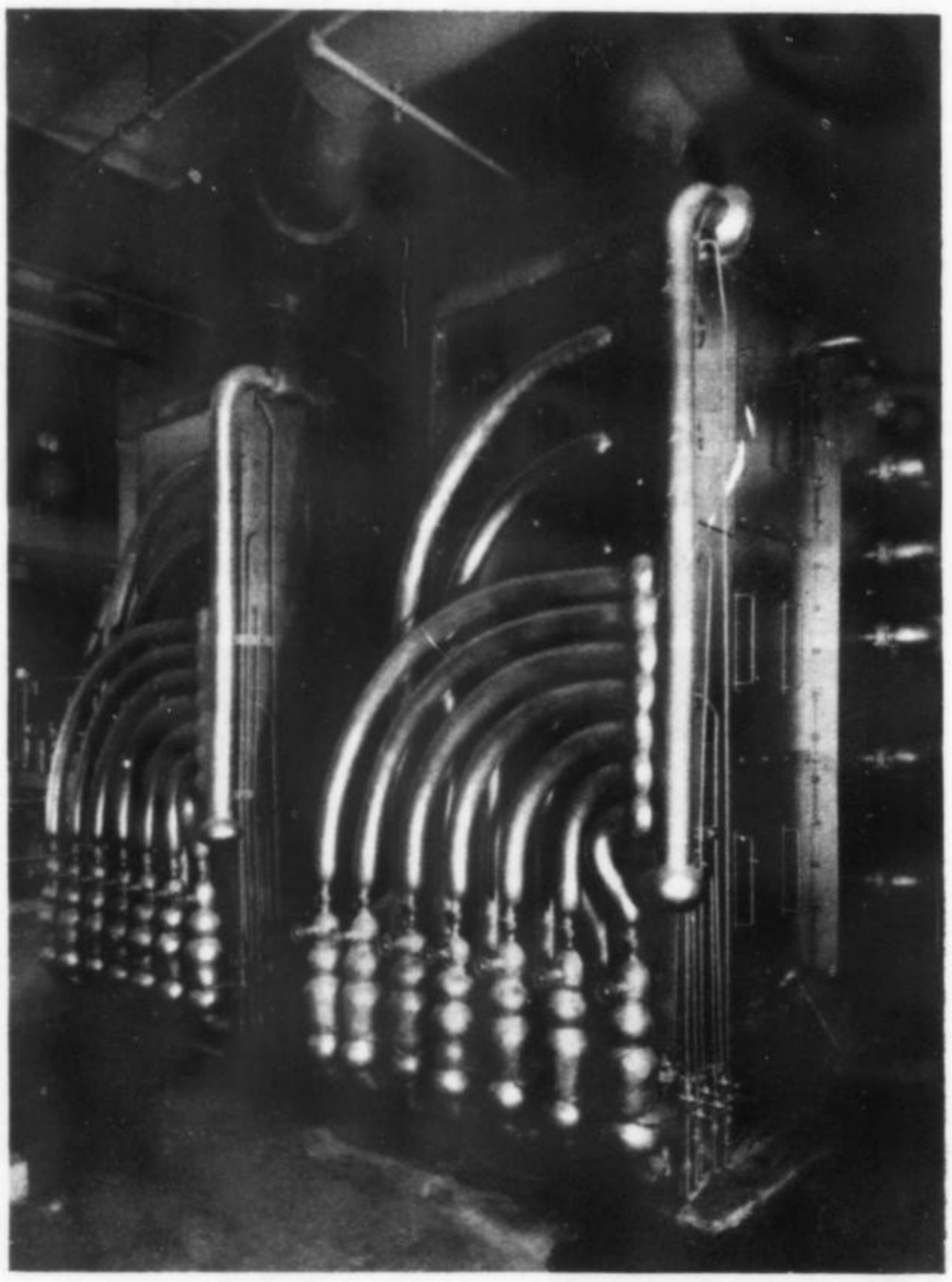
In the last-named case it was customary until recently to drill by percussion methods or by rotary shot, but the job has been speeded up by adopting the American oil well technique. Boring is done by high speed rotary bits in conjunction with a high pressure stream of liquid mud, which flushes the debris to the surface as it is produced.

Salt is being obtained through a bore-hole made in that way near the mouth of the River Tees, England, and the brine is being refined into table salt. By this method of drilling, a well 1,000ft. deep can be drilled in days instead of weeks.

The most extensive salt mines in the world, at Wieliczka, Poland, have been worked for centuries and still show no signs of becoming exhausted. The salt here is not high grade, being mixed with clay, but the deposits are more than 400 yards thick and the galleries have a total length of more than 500 miles.

Deposits in Britain supply about one-tenth of the world's needs. Utah, America, has the largest salt lake in the world, 75 miles long and 20-50 miles wide, with brine one-sixth salt. The harvesting ponds to which the brine flows are the biggest salt pans in the world. Here the salt is obtained by evaporation.

Salt produced in Britain is similarly obtained mainly



Photos © Imperial Chemical Industries

UNDERGROUND LAKES & WELLS provide much of the salt for many countries. Those in Cheshire, England, have the strongest natural brine in the world, most of the salt produced in Britain being obtained from underground lakes. Above, this dryer with its battery of curved pipes removes the last traces of moisture from the salt.

COMMON SALT is found in the oceans, salt lakes, salt wells and salt mines. In almost every part of the world salt can be found in underground mines. Most lie far beneath the surface and the salt is mined like coal. Photo above shows rock salt being mined in Great Britain where deposits supply about one-tenth of the world's needs.

from brine, though the lakes are underground. Cheshire, England, has the strongest natural brine in the world. The liquid is evaporated in artificially heated pans, and the size of the crystals depends upon the speed of evaporation, fine salt being produced rapidly and coarse salt slowly.

Some facts about salt are startling to the layman. Thus, if an active cell in a mild saline solution has its medium changed to one of pure water it swells and bursts. Saltless water kills a higher animal partly by causing the blood corpuscles to rupture and discharge potassium salts into the blood stream, and partly by stopping the kidneys from functioning—they cannot do so without salt. The burst blood cells also paralyze the heart, not only directly by the potassium, but also indirectly because they are no longer able to carry oxygen from the lungs.

A quarter ounce a day keeps the doctor away

It has been computed that the human body needs about ¼oz. of salt a day to keep it healthy. Among the functions of the salt we eat is the protection of the body against microbes; it has been found that serums which can kill bacteria are unable to do so if the salt is extracted.

Perhaps the strangest use for salt is in road building. America has a highway made of solid blocks of salt connecting Ithaca (New York) with the nearby airport, and this extraordinary highway has lasted 20 years without signs of serious deterioration.

London owes its situation indirectly to salt. Over 1,000 years ago Britain's salt mines supplied Western European countries, and on their way to the south coast of England the pack pony trains crossed the River Thames at a convenient ford near the present Westminster Bridge. Around the site of the ford a settlement grew up—the nucleus of the present city.

Today, despite the continually increasing demand for salt, the world is never likely to experience a shortage. Even in the inconceivable event of the salt mines and brine lakes becoming exhausted, the oceans contain enough of this vital commodity to meet our needs for thousands of years.

You do not have to take this statement with the proverbial "grain of salt." Seawater contains an average of three per cent of salt, and there are about 500,000,000 cubic miles of brine in the oceans of the world.

Clearly the name *common* salt is no misnomer, and its expanding uses today are not likely to be handicapped by any lack of the raw substance.

The Unesco Courrier. — July-August 1959

WHAT TIME IS IT?

A fictitious sun gives us the answer

by David Gunston

SINCE the very earliest times man has always been aware of the passing of time. It is something fundamental in life which, like space, we feel we understand but cannot easily define. Pulse beats, the movements of sun and moon, day and night, the tides, the changing seasons, youth and age—all these gave even primitive man this feeling of time's existence.

But although as we know from the evidence of the first sundials and the Egyptian water-clocks, he has long been interested in measuring the passage of time, human life got by quite well for many centuries without feeling the necessity of having a standard universal time. Cave men adjusted their lives according to the sun's movements, and so, basically, did civilized people until after the middle of the last century. Local time was all that mattered to the vast majority of the human race long after the perfection of mechanical timekeeping.

It was the development of railroad communications in North America that really led to the adoption of the universally recognized time system we know today. In Europe, English trains began to run to Greenwich time, French trains to Paris time, German trains to Berlin time. Local communities kept to their own mean sun time, and for a while it all worked fairly well.

But it was hardly to be expected that railroads extending their services over the Middle and Far West would adopt Washington time, which frequently differed by several hours from the local time of the regions they served. Owing to the vast E-W size of the American Continent the moment at which the sun appeared to pass immediately overhead at the meridian (noon) differed considerably in places of different longitude. So railroads in the United States actually started their own time, o with the longer lines, their own time zones.

As the system grew and more folk wanted to travel, this of course led to much confusion, especially at change-over stations, and it became obvious that a better solution would have to be found. The whole question of a standardized time-keeping system was discussed in conferences by the principal countries of the world during the years 1870-1880. Thanks primarily to scientists Charles F. Dowd in America and Sandford Fleming in Canada, a workable scheme was put forward and, after much debating, was finally adopted by the railroad companies of North America and eventually, in 1883-1884, by almost the entire civilized globe.

Stepping over a line makes today tomorrow

THE idea, like most good ones, was basically simple. There were to be accepted for the whole earth 24 standard meridians each 15° apart in longitude, for this purpose a meridian being taken to be an imaginary line circling the earth and passing through the poles. The prime meridian (0°), from which these were to be calculated was, by arbitrary agreement, that running through Greenwich, on the eastern fringe of London. Greenwich was partly chosen by way of international recognition of the importance of its famous Royal Observatory's contributions to astronomy and nautical science since its foundation by King Charles II in 1675.

Each longitudinal meridian was to be the centre of the one of the 24 fixed time zones each changing by one hour in passing to the next, back for westward from Greenwich, on for eastward. This also meant that at longitude 180° E. longitude 180° W. was also found, and so arose what is now known as the International Date Line and the convention of jumping a whole day of 24 hours when this point is crossed, gaining it in one direction and losing it in another. In practice, today, the Date Line does not keep strictly to the meridian, but curves round the Aleutian Islands and Fiji to enable the people of these, and neighbouring islands, to have the same day.

The advantages of this standard system were immediately obvious and now almost everywhere zone time based on Greenwich Mean Time (G.M.T.) is the rule. G.M.T. is kept all over Britain, and other countries have long adopted time zones corresponding to the selected meridians. Thus much of Europe keeps to Continental Time, 1 hour fast on Greenwich, while in North America the five time zones are used—Atlantic, Eastern, Central, Mountain and Pacific, respectively 4, 5, 6, 7 and 8 hours behind G.M.T. If New York preferred to adopt G.M.T., the sun would not be overhead until 5 p.m. Thus the system of "five hours back" is the answer. Certainly it is infinitely better than the chaos of 80 years ago, when there were almost as many time meridians as there were railroad companies.

Modern time begins at the G in G.M.T.

SO, in the strictly practical sense, Greenwich is the place where modern time begins. In point of fact, the Royal Observatory has now moved to the village of Hurstmonceux (pronounced Hurst-*mon*-soo) near Eastbourne, Sussex, on the South Coast of England, but as this place is close to the Greenwich meridian and allowance is made for the difference, the change in no way affects the validity of Greenwich Mean Time.

So far, however, we have been concerned with what is termed the mean solar day based upon arbitrary meridians. This would be completely accurate and useful if the earth and the sun were bodies rigidly accurate in their motions. But things are not quite so easy as that. The earth itself is tilted on its axis at an angle of 23½° from vertical, and its path round the sun is elliptical, not circular. What, then, are the basic concepts for the measurement of time?

All our sense of time is bound up with some movement, whether it be the sun in the sky or the hands on the face of a clock. But movement requires space, so it is evident at once that time and space are closely related, though of course if measuring time is one thing, defining it precisely is quite another. Indeed, the world's metaphysicians are still not entirely agreed upon a definition of time, which may therefore be long delayed.

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WHAT TIME IS IT?

(Continued)

On the scientific level, however, all our measurements of time depend primarily on the movement of the earth spinning round on its axis, and round the sun—the first enabling us to count off successive days, the second successive years. Thus we see clearly why time-measuring has always been an important part of practical astronomy. Why, in fact, what we call "the right time" is originally given to the world by observatories and not by railroad stations or shipping offices.

To tell the time of day we need first of all a moment at which we consider each day to begin. Whereas for civil purposes in our daily lives this point is taken to be midnight, the natural day commences at noon that is, when the sun crosses the meridian. But the intervals between successive noons throughout the year as measured by this method are far from equal, because of the eccentricities of the earth's behaviour in space. The daily errors mount up, and clocks set solely by the sun would be hours wrong within months. The sun is, in fact, not a particularly good timekeeper.

If instead of using the sun we measure time by the apparent daytime movement of the stars no such inequalities are noticeable. Star time, thus obtained, is called Sidereal Time and for strictly scientific use, as in astronomy, it is the only true time. Why should this be so? When compared with our sun the stars are infinitely distant, and even when the earth moves round the sun for say six months to occupy a position in space which has changed by nearly 200 million miles, the apparent position to us of the stars has changed only by amounts too infinitesimally small to affect earthly calculations to any important degree.

So, aware of these basic errors in solar time, the system of Mean Time had to be introduced, which is based on the movements of a fictitious sun which gives us every day of exactly the same length and equal to the apparent length of the solar day. Mean Time can best be defined by the going of a perfect clock which is so set that, in the average (mean) of the whole year, it shall be as much ahead of solar time as behind it.

Most accurate 'clock' gains twelve hours in six months

THE greatest difference between clock and sun would then be about 16 minutes, occurring in one direction early in November and in the other about the middle of February. This vital difference is called the Equation of Time, and it represents (from a highly accurate astronomical point of view, only roughly) the difference between apparent solar time and G.M.T. This data is given for each day in Nautical and Domestic Almanacs, thus enabling domestic clocks and ship's chronometers to be set by the sun. Wherever reasonably exact time is of importance, a similar system to this is in use.

For the astronomer, Sidereal Time is of the utmost importance. He reads it by measuring the daily motion of that point in the equator from which the true right ascension of the stars is reckoned—what he calls the vernal equinox. Two upper transits of this over the same meridian determine a sidereal day, which is actually shorter than a mean solar day:

1 Mean Solar Day = 24 hrs. 3 mins. 56.5554 seconds, sidereal time.

1 Sidereal Day = 23 hrs. 56 mins. 4.091 seconds, mean solar time.

When he is about to make time observations the astronomer sets his telescope at the proper angle to watch the passage of the star across the meridian. His instrument has between 5 and 11 spider-lines ruled across its glass, the centre one set on the meridian. He records on a chronograph, or highly precise stop-watch, the star's transit over each line by interrupting his electric circuit with a hand-held key, which itself is connected electrically to the chronograph and on which a break-circuit chronometer is making a continuous record. The chronograph sheet can afterwards easily be interpreted, and Sidereal Time calculated. A sidereal clock, however, is useless for ordinary day-to-day timekeeping, since it gains 12 hours on an ordinary clock in 6 months.

Ordinarily speaking, we must still live our lives by the sun, getting up around sunrise and going to bed when darkness has fallen. So we must have a practical system based on the sun, and the thing works better if we replace the unreliable real sun by this imaginary (mean) sun, which crosses the meridian at uniform intervals and goes round the equator at a fixed rate adjusted so that the real sun and itself each take exactly one year to make the circuit.

Quartz crystal clock keeps time to 1/1,000th of a second

THIS man-devised compromise brings us back to Greenwich and its long-proved Mean Time, which is actually the Greenwich Hour Angle of the mean sun, plus 12 hours to make the day begin at midnight. And as such it meets all the needs of the ordinary world—though of course under zone time systems the true (sun) time is applicable only exactly on the meridians, which however causes little inconvenience in practice.

The famous old Royal Observatory at Greenwich suffered some bomb damage in World War II, but it was moved from London chiefly because that city's brilliant street-lighting (unknown in Charles II's day) had made night-sky observations and long-exposure photography practically impossible. The move to Hurstmonceux Castle, "the most perfect example of the mansion of a feudal lord in the South of England," and built in 1446, is now almost complete, but the new Observatory still retains its ancient description of Royal Greenwich Observatory.

Six telescope domes—one for the new 100-inch "Isaac Newton"—and modern office blocks now ring the Tudor turrets, but all the old work of time-keeping and astronomical observation continues and is expanding in ideal surroundings and with up-to-date equipment. The well-known Greenwich Time Signal, or "pips," is still broadcast to the world every 15 mins. from an astronomical "Regulator" radio clock governed by a quartz crystal clock. This is constantly checked and compared with the time signals of Paris and elsewhere, so that it and all the Observatory clocks keep time to within 1/1,000th of a second per day.

Before the telegraph was invented, observatories gave their time signals by bell-ringing, whistle-blowing and the dropping of elevated time-ball signals on their towers, but nowadays G.M.T. is relayed by radio continuously all over the globe for the benefit of other observatories, radio stations, ships and aircraft. Any individual or traveller with suitable radio receiving equipment can receive a time-signal over the ether correct to within 1/100th of a second, but in general it is the ordinary broadcasting stations which perform the most public service by regularly issuing time checks. The U.S. Navy Observatory at Georgetown Heights, Washington, however, accepts no responsibility for time signals other than its own, and every day at noon still uses a time-ball, as well as automatically correcting all the clocks in the Government Buildings there.

As you will have seen, time-keeping is a trickier business than it at first seems, but it has now been perfected as much as is humanly possible. It's not often science's fault if you are late for an appointment!

Almost all of central Rotterdam was razed to the ground by a single bombing attack on May 14, 1940 and by the great fire which followed. Today Rotterdam is one of the most imposing cities in the Western world, with fine modern buildings, a simple yet daring architectural style, spacious avenues, and works of art, which are all strikingly integrated into the new urbanization plan. Left, "Construction", a motif in metal by the sculptor Naum Gabo which stands on the Coolsingel, Rotterdam's "Champs-Elysées".

All photos Lies Wiegman © Agence de Diffusion Internationale

MIRACLE AT ROTTERDAM

by Michel Salmon

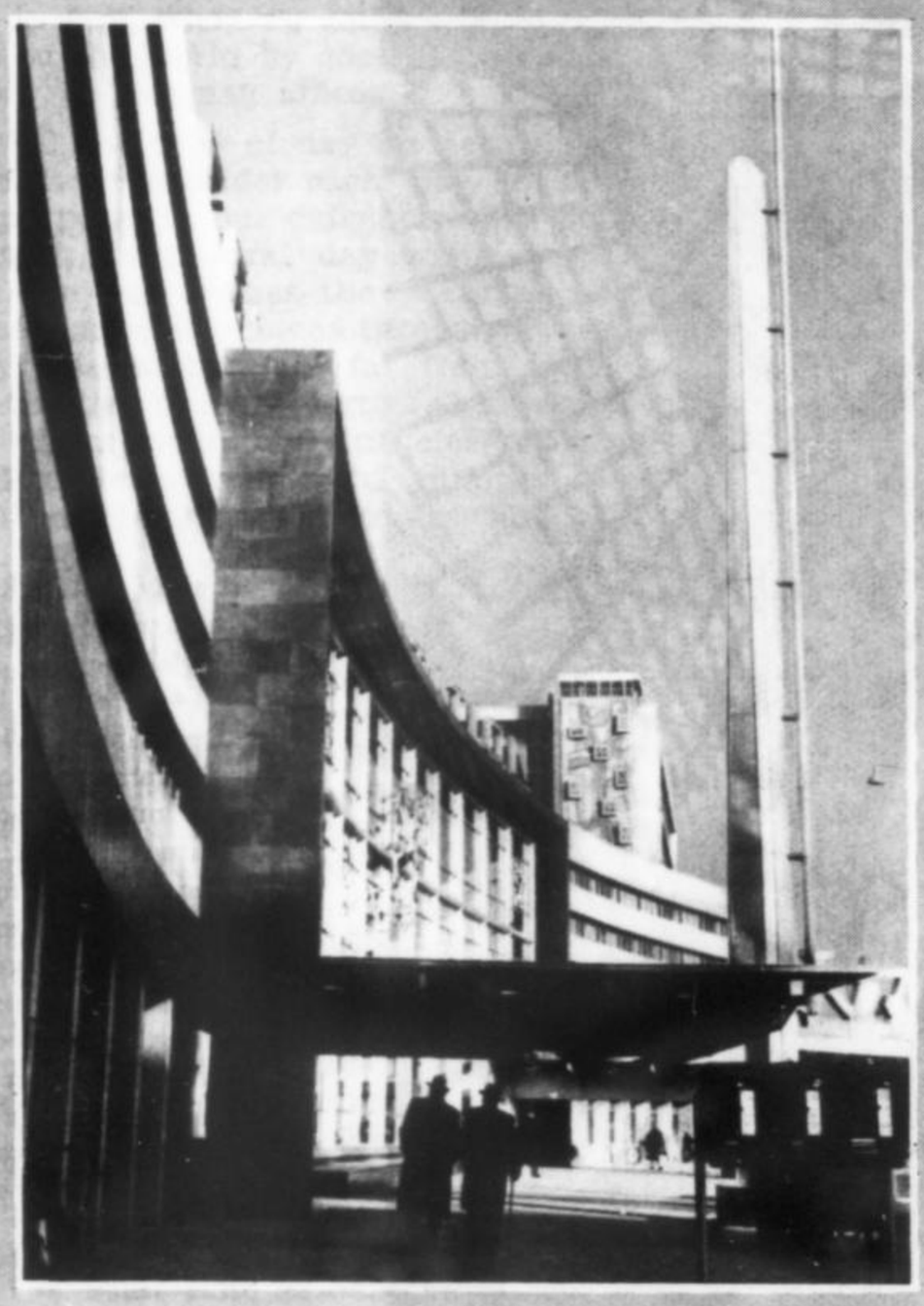
I love Rotterdam as some people love rain or the blustering wind or cold, stimulating weather that quickens one to activity. There is a good reason for comparing it with the weather. The sea is Rotterdam's cradle; it is the backcloth to its great stage crowded with docks, houses, esplanades and factories on which rain, wind and cold often appear as actors and "extras."

But Rotterdam also has its ruins, or rather its memories of ruins—clean and tidy sites from which rubble has been carefully cleared. "Rotterdam has not yet recovered from its wounds, but the scars are not too unsightly," my friends in Rotterdam say, with a smile. Yet wounds like these take a long time to heal; a town can be destroyed in a few hours, but takes a decade or more to rebuild.

And now I am back in the centre of the city, walking down the Coolsingel—the "Champs-Elysées" of Rotterdam. It looks futuristic with its fountains, striking statues, parks, large new buildings and houses, its model shops and its glittering cinemas—

MIRACLE AT ROTTERDAM

(Continued)



ingenious combinations of glass, aluminium, stucco and lights. The crowds surge and hurry along, and everywhere there is a smell of roasting coffee, petrol and freshly laid cement.

At the liberation, on May 5, 1945, more than 20,000 of Rotterdam's citizens had been killed by the Nazis. Nearly 800 of these perished in the bombing of May, 1940.

As a result of the raid 11,000 buildings were destroyed, and 25,000 families, or 80,000 people were left homeless. Altogether, 2,393 shops, 1,500 offices, 1,212 factories and mills, 675 warehouses, 526 restaurants and cafés, 184 garages, 69 schools, 21 churches, 12 cinemas, 6 concert halls, 4 hospitals, the 4 stations, 2 theatres and 2 museums were reduced to ashes. Over an area of 642 acres everything was reduced to dust. There was nothing left of the centre of the city or of the old harbour, so dear to novelists of the sea, from Conrad to Cendrars.

On that tragic May 14, Rotterdam was set on fire by incendiary bombs. High explosive bombs had already destroyed the water mains and the firemen were unable to stop the blaze from spreading. Rotterdam burned for forty days and forty nights. When the last fire had burned itself out there were over 6,000 million cubic feet of rubble to be cleared away.

In the ensuing weeks and months, workmen had to dig out of the ground, like so many stumps of decayed teeth, 160,000 foundation piles, of a total length of 1,240 miles—as far as from London to Moscow. (The soil in Rotterdam is so loose and damp that buildings have to be set on a foundation of piles.)

Mijnheer W.G. Witteveen, the chief architect of Rotterdam, found a room in the municipal library, which was still standing, and began to work feverishly on a plan for the rebuilding. Though no rebuilding was permitted during the occupation. The famous Witteveen plan became a kind of a symbol—and never was a secret so well and yet so badly kept. The whole town knew of it ; and the thought of the garden-cities and skyscrapers to be, made destruction, hunger and fear seem less terrible.

I do not know how much of the Witteveen plan there is in the Rotterdam of today. I have watched the city recover; and, every time I have come back, there has been still more feverish activity, with scaffolding everywhere and the suburbs spreading outwards in all directions, so that it gives the impression of a new city "sprung up overnight," rather than an old city rebuilt.

All I know is that in July 1959, Rotterdam is one of the most impressive cities in the West. From the top of the *Groothandelsgebouw,* one of the biggest commercial buildings in the world (it has 11 storeys and is 720 feet long and 280 wide), you can see that a master plan has been followed. In the background is the harbour, with its stately lines of ships anchored at the docks, its forest of cranes, hoists and oil-cracking towers (the native of Rotterdam tends to think first of the harbour and then of the city beside it). And from the harbour to the polders delimiting the city to the north, south and east, the 1,980 acres of this town of 750,000 souls is divided up into broad avenues, huge squares and compact blocks of modern houses with green spaces

between them. (Almost 70% of the area of Rotterdam consists of open spaces)

This is architecture on a humanistic level, architecture to the measure of man, resisting the temptation to build on a colossal scale and yet not infected by the nostalgic conservatism which thinks it sacrilege to touch what is old, even though it be a slum.

On the "Coolsingel" is the massive, Mycenaean cube of the "Bijenkorf", a department store designed by A Elzas, of the Netherlands, Marcel Breuer, of the U.S.A., (one of the three architects who planned the new UNESCO Headquarters building) and another American, Daniel Schwartzman. At every turn you find a masterpiece of modern art—a fresco by Louis Van Roode on the wall of the post-office; a bronze by Marino Marini, taut as a bow on the "Zuidplein"; in the station hall a sinister-looking rock with the beauty of a black diamond, carved by Umberto Mastroianni; an animal group by Anne Grimdalen in front of the Town Hall ; and of course Zadkine's touching statue, symbolizing the desecration and resurgence of the city.

Rotterdam has opened its doors to a "League of Nations" of architects, decorators and sculptors. From all over the world they have come, and have created here a universal idiom for the cities of the XXIst century. It is a triumph of internationalism, in both mind and heart. It is a triumph of understanding and international cooperation, in this great seaport opening onto adventure the wide world over, and teaches the sceptical the lesson that miracles can be worked by determination.

CITY OF AIR, LIGHT & WIDE OPEN SPACES

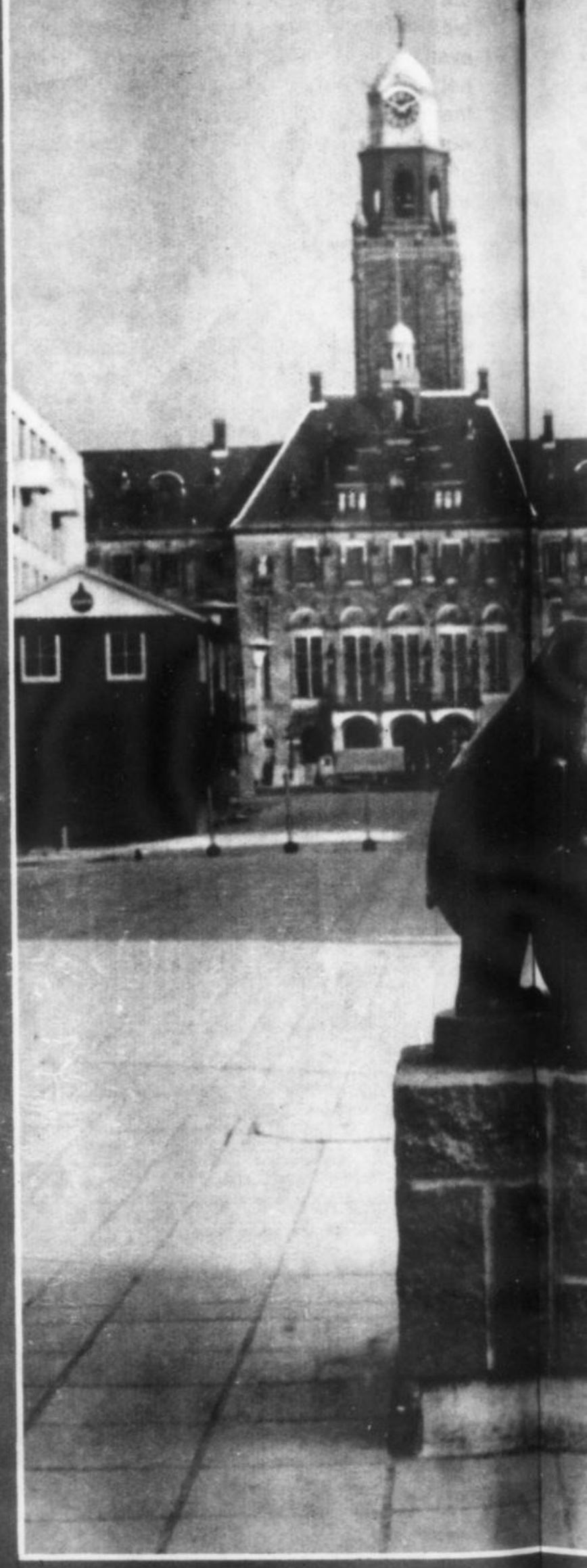
The new Rotterdam which has risen from the ashes of war is a city of air, light and wide open spaces. In the heart of town, shown in this panoramic view, seventy per cent of the total area has been reserved for open spaces, compared with some 45% in the pre-war city. Though the area available for building sites has been nearly halved, the erection of taller buildings—made possible by new, wider roads—and a more rational use of space, has kept the building volume virtually unchanged. In this photo, taken in 1957, work was still being carried out on the Central Station (left) and on the Post Office building (left, background). Completed station is seen in photo, opposite page. Other important buildings visible in rooftop view of Rotterdam: old town hall with its tower and new 14-storey blocks of flats. In planning urbanization, city authorities kept area on right of photo clear for future development. New projects include a hotel, a vast office building and a concert hall.

SYMPHONY OF ART AND ARCHITECTURE

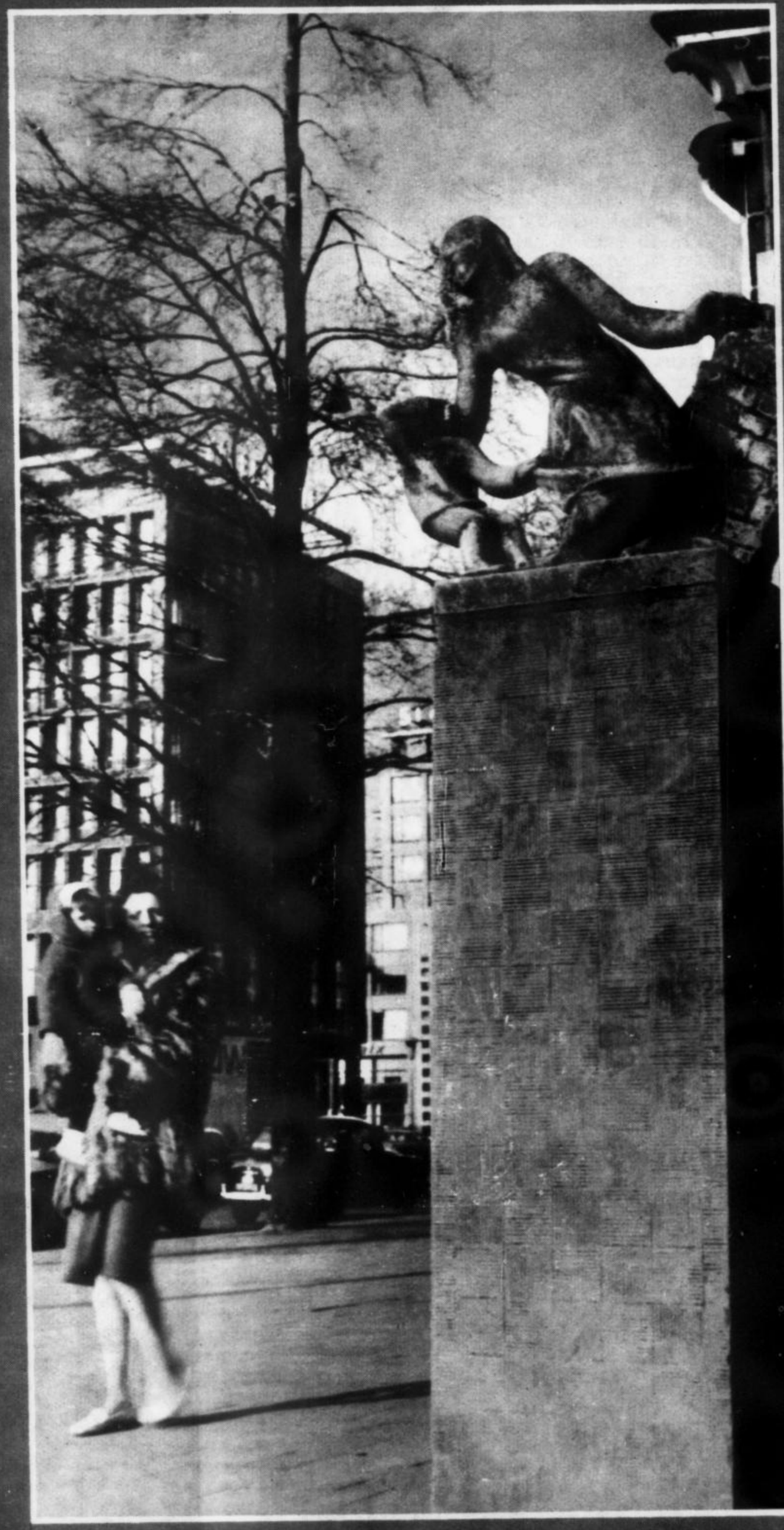
A symphony in concrete, glass and stone, the new office buildings and appartment houses of Rotterdam glisten in the afternoon sun. The Rotterdam of today can truly be said to be both beautiful and functional for its architects have added to the basic utilitarianism of their designs the varied works of decorators, sculptors and other artists of different schools. The whole destroyed area of Rotterdam was requisitioned by the municipality to make a centralized planning scheme. Former property owners were given options on new building sites, but could claim compensation only if they used the full amount for rebuilding. The result has been a rational growth of shops and buildings (left and below left). Underneath the great blocks of flats are a variety of small shops which have brought the shopping public back again to the heart of Rotterdam. Amid all these transformations, those who died in the holocaust of May 1940 and throughout the war years are not forgotten. In the Stadhuisplein now stands a memorial to the victims of war—a group of massively-hewn figures by the sculptor Mari Andriessen (right and below).

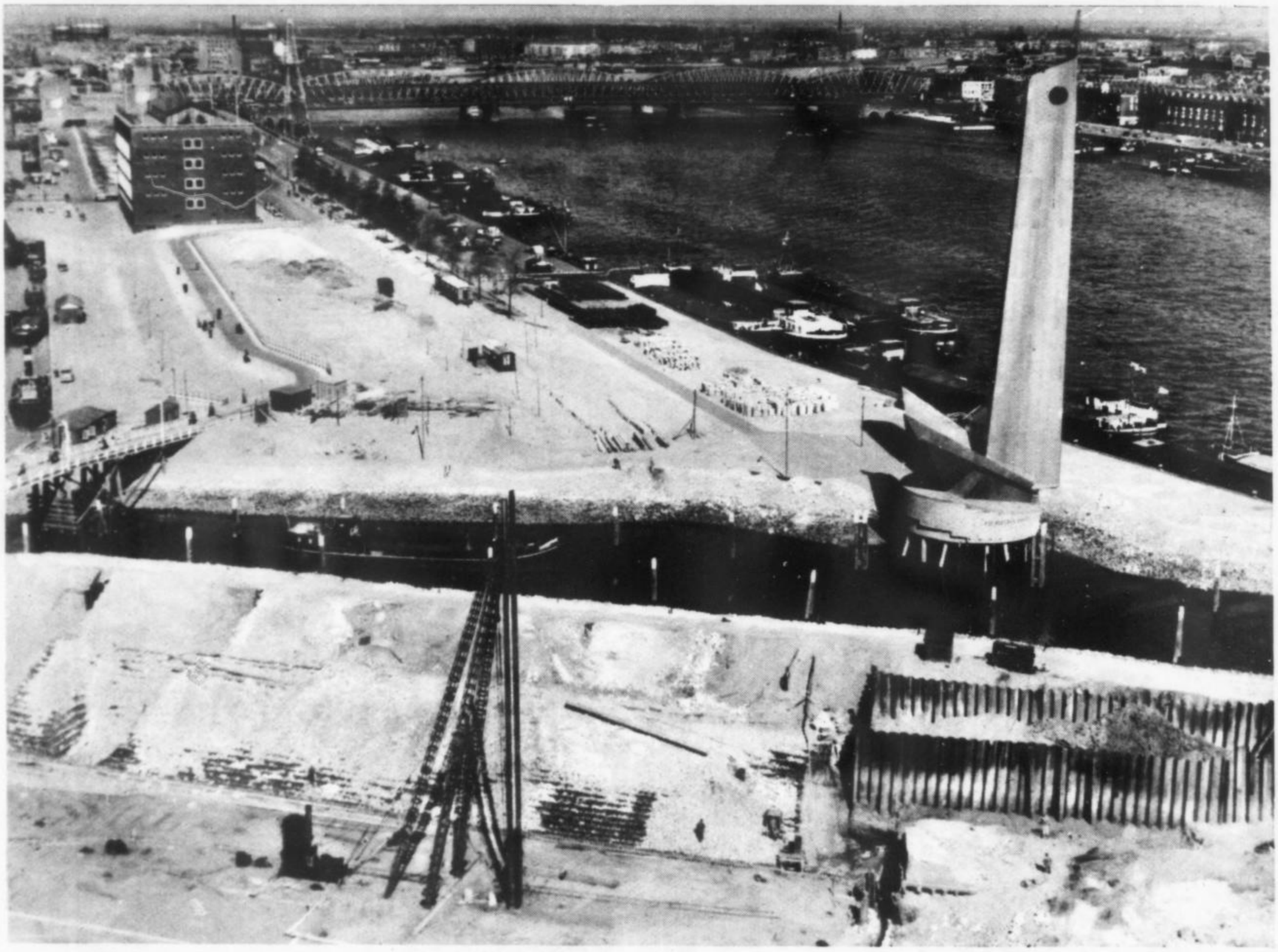
ART IS REBORN AS THE CITY RISES AGAIN

The works of modern art which decorate the streets and squares of Rotterdam are a triumph of international co-operation, combining as they do the talents of artists of many lands. Many of these works have been erected to symbolise Rotterdam's destruction and suffering. In the Lijnbaanplein, which is fast becoming the new cultural centre of south Rotterdam, stand (left) a bronze by the Italian sculptor Marino Marini, in memory of war victims. Centre, a group of bear cubs at play—one of the world's



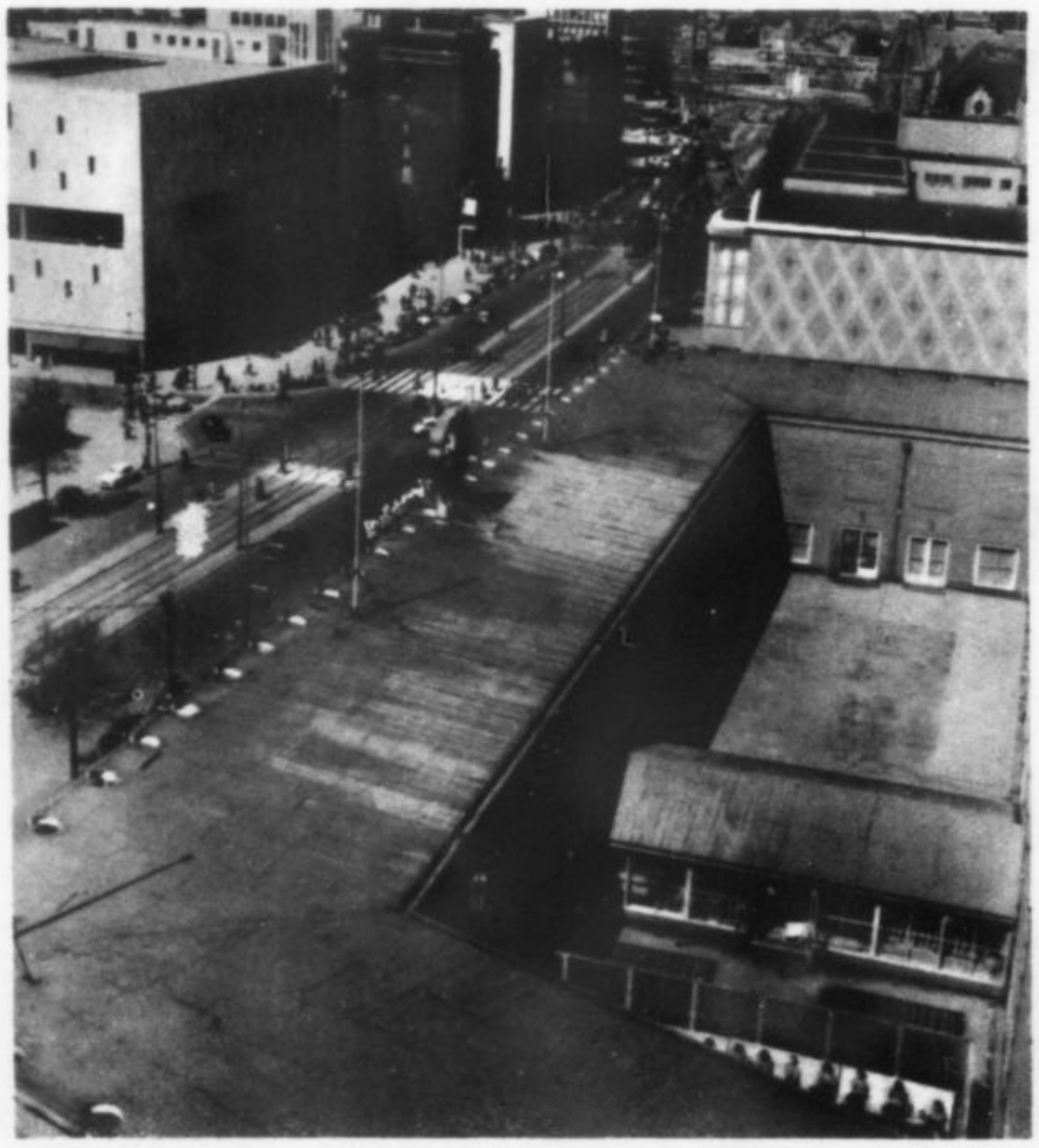
...s and squares of Rotterdam ... as they do from the hands of ...en erected as testimonies to ...dplein, which is destined to ... stands "Il Grande Miracolo" ...ni, in honour of Rotterdam's ...e work of Anne Grimalden of the Netherlands. In the background is the City Hall with its tall tower—one of the few buildings which escaped complete destruction in the bombardment of 1940. Since the city was reconstructed this building has been thrown into new-found prominence by the widening of the pavement in front of it and the construction of a new square opening in the Coolsingel Boulevard. Further along this sweeping boulevard is a small yet poignant reminder to those who pass of the city's past ordeals—the statue of a mother shielding a child as walls crumble around her.





HARBOUR FLANKED BY A CITY

The people of Rotterdam tend to think of their town as "a port surrounded by a city", for Rotterdam is the Netherland's chief port and the second largest in the world. Extensively damaged in 1944, it was back in working order only six months after VE Day. Photo, above, shows the River Maas. An embankment and a broad boulevard have been laid out and a new inland shipping lane extends right to the city centre. Monument at right, "The Bow" is for war victims of the merchant navy. Below, two views of central Rotterdam.



ELECTRONIC TRANSLATORS WITH BUILT-IN DICTIONARIES

by Emile Delavenay

THE idea that an electronic machine should be able to do automatically all or part of a translator's work—consult a dictionary or translate a written text from one language into another—may seem fantastic at first sight.

Yet the idea has been gaining ground ever since it was first put forward by an Englishman, A.D. Booth, in 1946; and today the goal is almost in sight for the many British, American and Soviet scientists who have been working on this problem for the past twelve years.

Automatic digital computers were invented to carry out at high speed *sequences of arithmetic operations* which would have been too time-consuming for human beings and which involved too great a risk of error. They have proved that they can solve problems of industrial and business management which, in addition to *automatic computing,* call for certain *logical decisions.*

In both cases—scientific calculation and business management (of which operational research is one aspect) —the machine receives two types of *information:* numerical information in digital form, and alphabetical information—i.e. words in current use fed in as letters of the alphabet. It automatically converts both types of information into a *code* suited to the particular operations it has to perform.

These include, for example, the logical identification of a quantity or a word with its equivalent stored in an electronic memory; automatic computation; the shifting of partial results from one memory to another; the selection of instructions depending on the type of result obtained; and lastly, the "output" of the final result, which may be in typewritten form. The most important feature of these machines is their breath-taking speed: some operations are performed in a millionth of a second.

Automatic translation could be envisaged as the following sequence of lightning operations without human intervention: feeding of a word into the machine, looking up and identification of the word in the electronic dictionary, simultaneous identification of the word's equivalent in the second language, and finally typing of this equivalent. The electronic dictionary is therefore a bilingual dictionary—like those used for ordinary translating—but recorded in a magnetic memory.

★

THIS series of very simple operations is only suitable, however, for words recorded in the dictionary in the same form as they appear in the sentences—i.e. invariable words—and which, moreover, have only one meaning. Special problems are raised by variable words, by those having several different meanings, and also by the word-order, and by idioms, or expressions whose general sense is different from the sum of meanings conveyed by the individual words.

In Britain, the United States, the U.S.S.R. and Japan, research has therefore concentrated for a number of years on the problems raised by the variable forms of words, by syntax, idioms and words with multiple meanings. Russian, English, German, French, Hungarian, Norwegian, Arabic, Chinese and Japanese have been analyzed for the purpose of reducing all the facts and rules of each language to *algorithms,* or numerical systems enabling the machine to translate sentences from language A into language B.

Highly complex programmes have been worked out which may involve up to ten thousand logical operations for the translation of a twenty-word sentence. Yet even so, the speed of the machine is such that the process is faster than ordinary translation. Just as the digital computer consults tables of logarithms or of functions, so the automatic translator will consult grammatical, morphological or syntactical tables in addition to its electronic dictionary. It scans tables of prepositions, tenses of verbs, declensions or conjugations—doing in fact the same work as the translator has to do when deciphering a text in a complex foreign language. These tables and the dictionary are made up of series of digits representing the algorithms of the input and output languages.

Before the facts of language could be reduced to algorithms, it was necessary to discover certain rules overlooked in the old type of grammar, because these grammar books were written for thinking human beings and not for unconscious machines which can only recognize explicit signals.

★

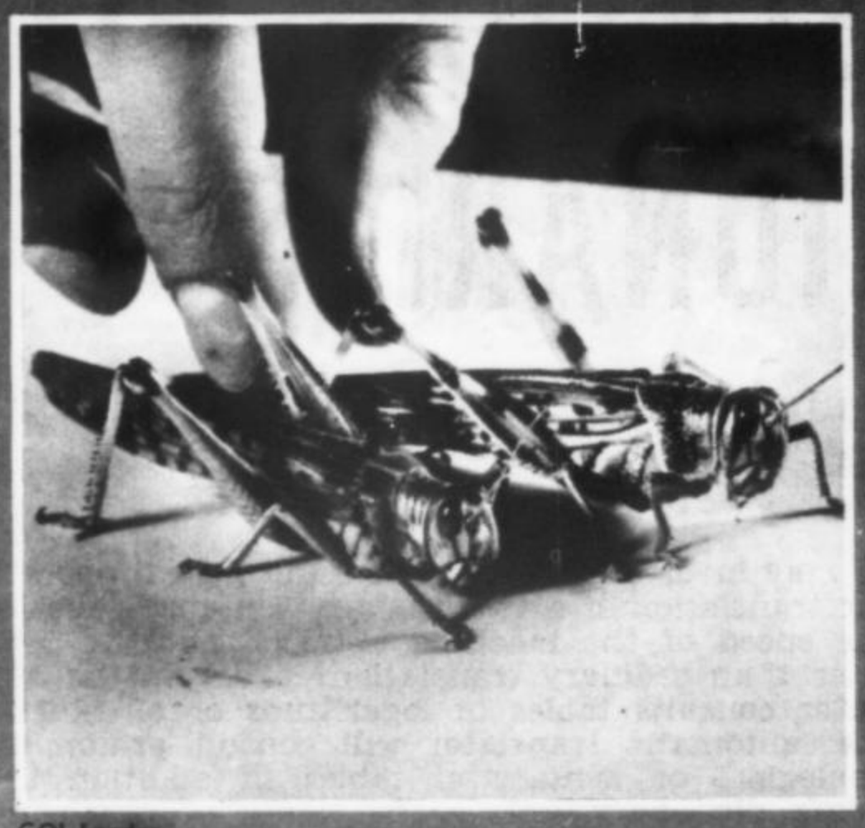
THUS research to put translation on an automatic basis is opening up new vistas for the linguist. It is leading to various kinds of studies on "signalling" systems of spoken and written language. Each language is being studied scientifically, in the minutest detail, and valid mechanical criteria are being discovered for the understanding of sentences—a field in which intuition might well have been thought the only possible guide.

The day of the translation machine is not far off, but much still remains to be done. Electronic machines can translate, but men have not yet learned to exploit their amazing potential. It is now up to the linguists —those of today who can and must adapt themselves to the new world of electronics, and those of to-morrow who, with the help of machines, will extend the scope of linguistics to cover all languages and all aspects of language. For the linguistic research required to perfect a translation machine is impossible without the aid of ultra-rapid new machinery.

The future belongs to the linguists and mathematicians, the "programmers", who can grasp the behaviour of words in a sentence, as well as language statistics and the working methods of computers. As in automatic computing and in management by computer, the machine can only perform automatic and repetitive operations. All the creative work, the most important task, will devolve upon man; he must use his imagination and judgement to work out programmes which the machine will then perform blindly and unconsciously.

For all sorts of reasons, scientific texts are the first which can and should be submitted to the special analysis required for automatic translation. Up till now, research by American, British and Soviet scientists has been concerned with texts dealing with mathematics, chemistry, electronics and plant genetics. The need for scientific translations is such in all countries that we cannot even begin to solve this problem without the help of machines.

But will machines ever be able to translate "literary" texts? The more optimistic research workers are beginning to hope so, and already have notions of the way to set about it. When this day comes, when all prose works can be translated automatically at scarcely believable speeds (there is talk of 20,000 words an hour), the peoples of the world will truly be able to learn about one another and appreciate each other's scientific and literary riches.



COI London

A DESERT IN THE HEART OF LONDON

by Daniel Behrman

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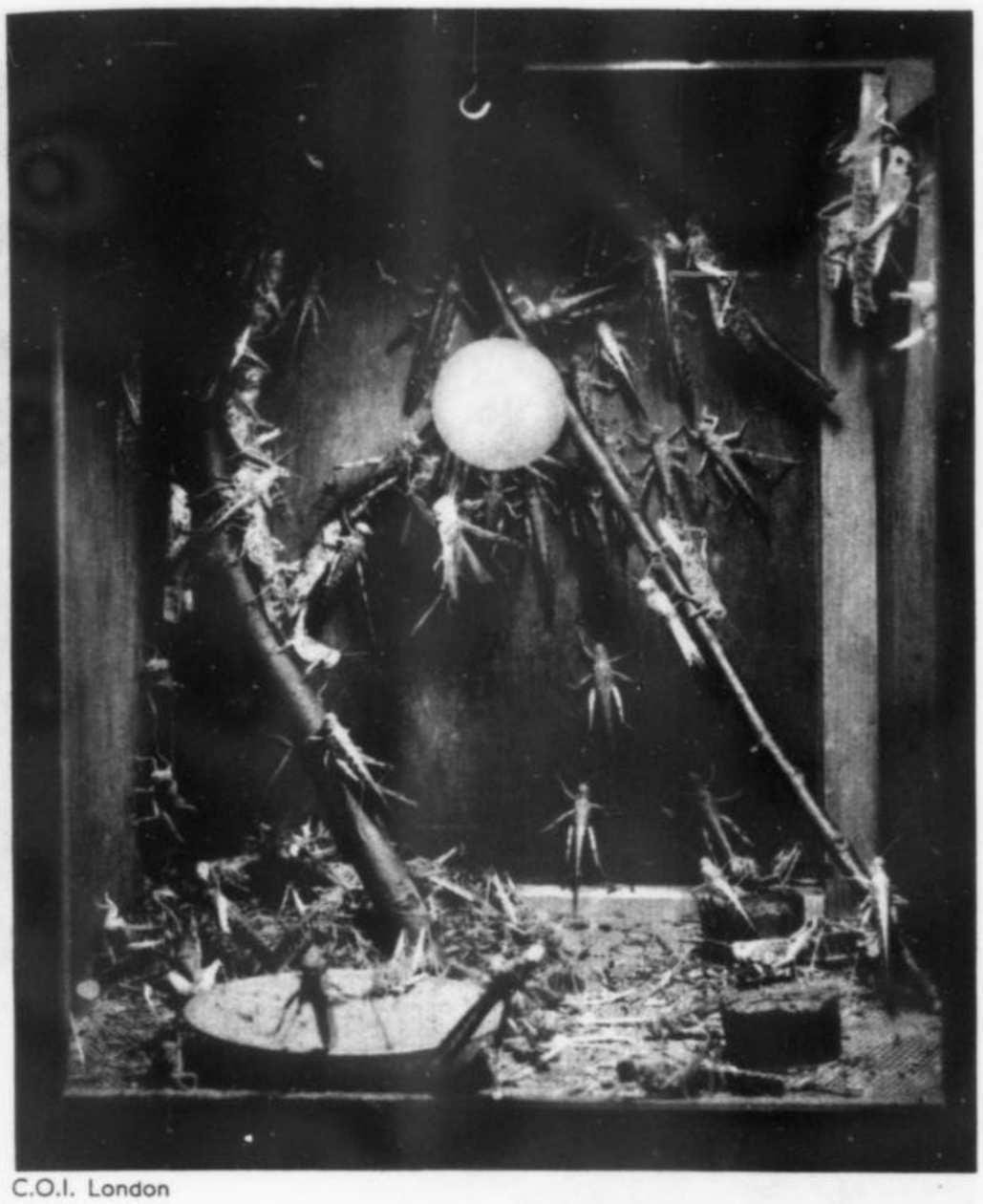


C.O.I. London

There may be a "pea-soup" fog or a sharp frost outside, but at the Anti-Locust Research Centre in the heart of London, a hot desert exists all year round. Here a million locusts are bred annually and their behaviour studied to help the world fight against locust invasions. Left, locusts are bred in the laboratory where they are induced to lay their eggs in aluminium tubes. Eggs are about the size of a wheat seed, laid in batches of 40 to 100 in moist sand in a pencil-shaped burrow. A glue-like substance holds them and the sand grains together (below). Larger cages at laboratory (above) hold adult locusts, fed on fresh grass and bran. Large electric light bulb replaces sun; sticks, for climbing and to fly from, give recreation. Full generation takes three months.

UNATIONS

JUST the other day, an alert English lady with an interest in zoology breathlessly brought a *schistocerca gregaria* into a London police station.

"It's a desert locust," she told the sergeant on duty, "I found it in Hyde Park."

When news of the discovery reached the Anti-Locust Research Centre in London, the man who is perhaps the world's leading authority on locusts, Dr. B.P. Uvarov, merely remarked:

"Why not? We raise a million desert locusts a year across the road from Hyde Park . . . and some of them are bound to get away."

Dr. Uvarov is not worried because he knows they do so at their own risk. For the desert locust does not stand a chance of surviving in the English climate. Unfortunately, in an area covering no less than 11,000,000 square miles of the earth's surface, it not only survives but flourishes to the point where it is an epidemic plague—and such a plague is now afflicting much of Africa and Asia.

Desert locusts in swarms have been known to darken the sky as far west as the Canary Islands in the Atlantic Ocean and as far east as Assam. They ravage North and East Africa and even fan out south to Tanganyika and northward to Spain and Portugal. Every year, the Anti-Locust Research Centre estimates, they do £30,000,000 worth of damage to cash crops in some 65 countries. No estimate, however, can be made of the harvest of suffering and starvation they sow in the arid and semi-arid belts of Africa and Asia.

The Anti-Locust Research Centre, operated by the British Government, has been in existence for fifteen years, but Dr. Uvarov has spent most of his life with locusts. In his office overlooking Hyde Park, Dr. Uvarov stated the centre's objective in few and clear words:

"We want to find out what conditions produce the initial swarms which cause all the trouble and then, if possible, we want to find out if these conditions can be changed economically."

Africa freed from two plagues

WHEN Dr. Uvarov first began to study locusts (they interested him even as a small boy), there were three main species plaguing Asia and Africa: the red locust, the migratory locust and the desert locust. In 1929, a locust invasion of the Middle East led to the birth of the predecessor of the present-day research centre. Then, it was only Dr. Uvarov and an assistant.

But, even thirty years ago, Dr. Uvarov was already preaching that "locusts ignore boundaries" and the scope of his work quickly became international. He and his collaborators attacked the problem from all sides: biological, geographical, physiological and meteorological.

It was the most unglamorous side of the job—the patient collecting of locust reports, and plotting them on maps—which led to their first victory. Once records covering a sufficiently long period had been analyzed geographically (evidence of the desert locust goes back more than 2,000 years), they showed that swarms of the migratory locust started in what is now the Sudan Republic and that the red locust swarms originated in Tanganyika and Northern Rhodesia.

This methodical spadework in London led to the establishment of the International African Migratory Locust Organization and the International Red Locust Control Service which concentrate on preventing locusts from swarming in these regions. The result is that Africa has been free of red and migratory locust plagues for the past fifteen years, though Dr. Uvarov refuses to claim at present that this is definitive.

The desert locust is a much harder nut to crack. It is a nomad, like all the other creatures adapted to survival in the desert, and it travels in giant leaps. Breeding places of successive generations may be as much as 1,000 miles apart.

CONTINUED ON NEXT PAGE

A DESERT IN THE HEART OF LONDON

(Continued)

An ecological survey of its breeding places is now being conducted by two scientists, George Popov of England and Charles Rossetti of Switzerland, financed jointly by FAO and UNESCO (UNESCO's contribution is part of its major project on scientific research to aid arid lands).

The job is an enormous one: last year, the two men visited Sudan, Chad and Ethiopia and this year are working in Mauritania, the Sudan Republic (formerly French Sudan) and Niger. This is a long-term study of the conditions under which desert locusts breed.

In London, one huge room of the centre is devoted mainly to keeping track of the desert locust's movements. In this geographical service as well as in every other section of the centre, basic and applied research are happily married.

Each year the centre's geographers receive thousands of reports of locust movements which are invaluable to the basic research task of trying to pin down the insect's principal breeding areas. At the same time, these reports form the raw material which goes into the monthly bulletins of the International Desert Locust Information Service operated by the centre and sponsored by FAO.

For example, one morning, a short while ago, a sheaf of cables and letters was awaiting Miss Zean Waloff, who is in charge of this service :

"About half dozen swarms entering Pakistan from west. Locuswar."

"Eritrea no swarms reported hopper infestation Arkiko Wangabo now controlled. Locust Asmara."

Miss Waloff turned to a huge map covering one end of the room, but still not large enough to chart all the wanderings of the desert locust which has even been seen 1,200 miles out in the Atlantic Ocean.

"The situation is serious this year, she explained, there has been spring breeding in northern and northwest Africa from Morocco to Libya. We knew about heavy swarms in Arabia and the Middle East and now some are reported in Pakistan."

'Your country is being invaded'

ON the basis of this information, the anti-locust centre publishes forecasts in its monthly bulletin. If the situation is dangerous, special warnings are issued. The last one, in October 1958, reported heavy breeding in the Sudan, northern Ethiopia, Niger and Mauritania and predicted serious breeding early this year.

In emergencies, the centre uses "signals" by cable or even telephone. One such "signal" involved ringing up an ambassador in London to inform him that locusts were headed for his country from across the border of another country with which his capital had no diplomatic relations.

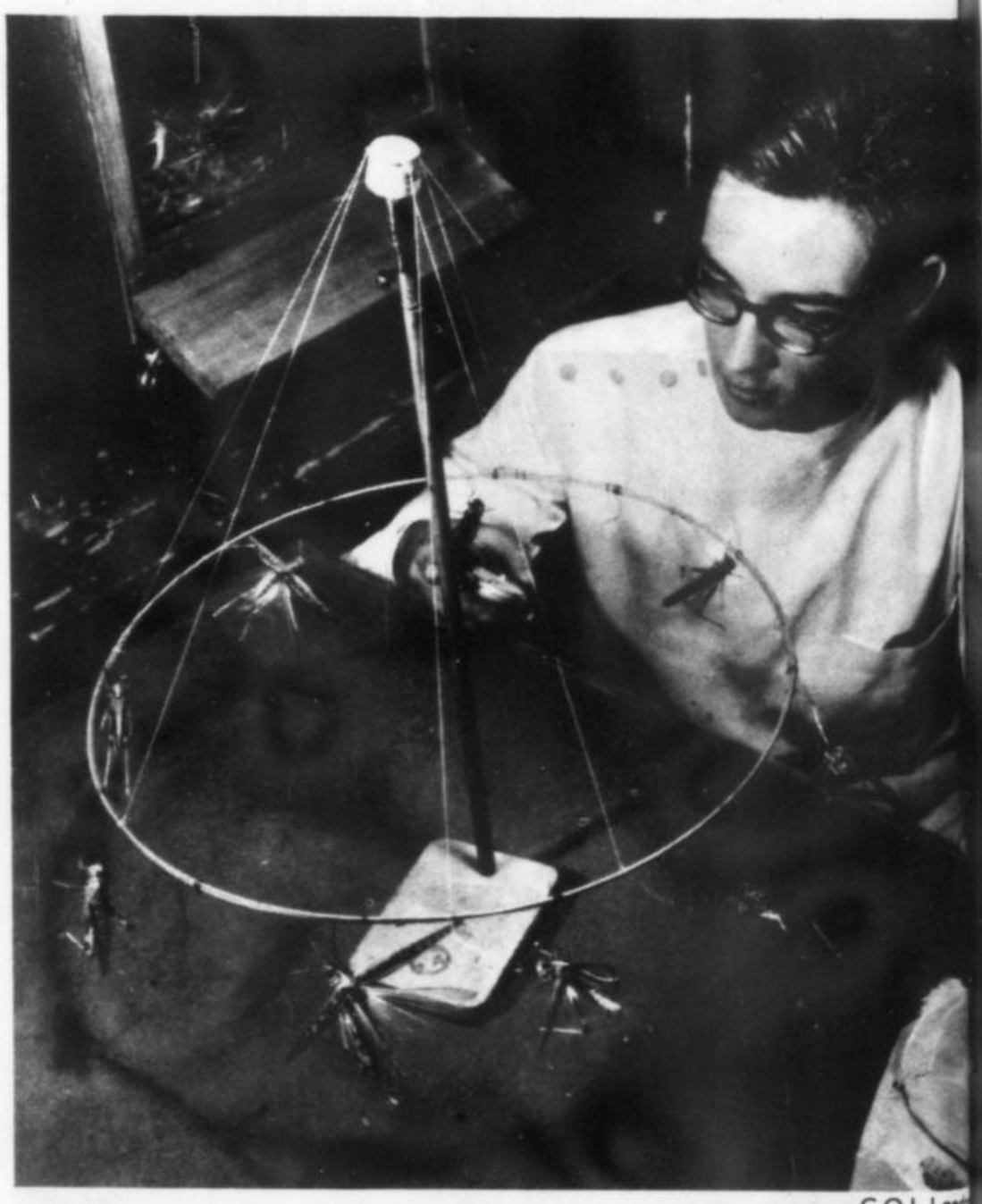
Locusts pay no attention to politics.

The Anti-Locust Research Centre in London is now directed by Dr. T.H.C. Taylor with Dr. Uvarov, his predecessor, in retirement, as a highly active consultant. A few doors away from Dr. Uvarov's office is a locust-breeding laboratory known to experts the world over. The locusts are either used for experimental purposes on the spot or are shipped out to universities and research institutes.

This is another case of basic and applied research going hand-in-hand. Locust-raising here is mass production at the rate of a million eggs and 50,000 adult locusts a year. In England alone, locusts are shipped (by ordinary post) to seventy scientists conducting research and they go to five universities in continental Europe as well.

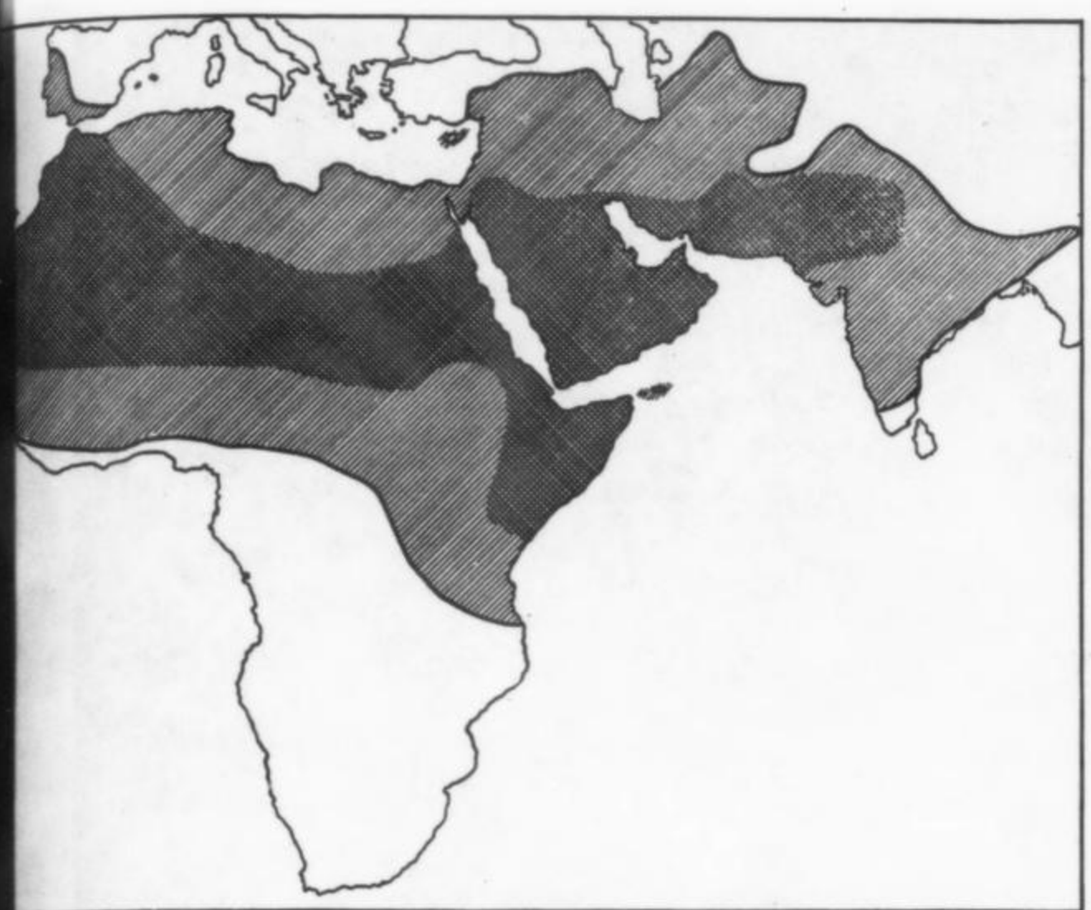
CONT'D ON PAGE 31

BABIES BY THE THOUSAND are produced daily in the Anti-Locust Research Centre and raised to adulthood. Fully-grown insects are then shipped to scientists in England and to universities in continental Europe. Even laboratories in Africa order supplies when locusts are "out of season" there.



C.O.I. London

'MERRY-GO-ROUND' for locusts used at London Research Centre. When the insects find themselves suspended in air, they begin to fly and turn the wire frame "roundabout". In this way, some estimate of the speed and duration of the flight of which they are capable can be made.



From "Climatology and Microclimatology", Unesco, 1958

INVASION ZONE of desert locust, divided into two parts covering 11 million square miles of Africa and Asia, shows size of the problem. Light shaded area shows total invasion area; central dark zone covers region where breeding or swarms occur at least one year in two.

★

HOPPERS ON THE MARCH

Life cycle of the locust consists of three stages: egg, hopper and adult. Locusts breed in the desert, yet lay their eggs only after rain. To develop, the eggs must absorb more than their weight in water. If not in contact with water during the incubation period (two weeks) the eggs die. During the hopper stage, lasting 5 to 6 weeks, the young locusts are unable to fly. They come together in bands of thousands, millions or even hundreds of millions and begin to march in search of green food, again only to be found in desert areas after rain. Excessive heat or dryness may kill the hoppers. For a few days after becoming adults the locust swarms take short daily flights to test their wings, prolonging these flights until a true migration starts. The hopper stage is the most vulnerable to attack by ground bait and aircraft spraying. Photo shows part of a vast army of hoppers on the march in a wheat field near Baghdad, stopped by an irrigation ditch too broad for them to cross.

FAO-Peter Collins

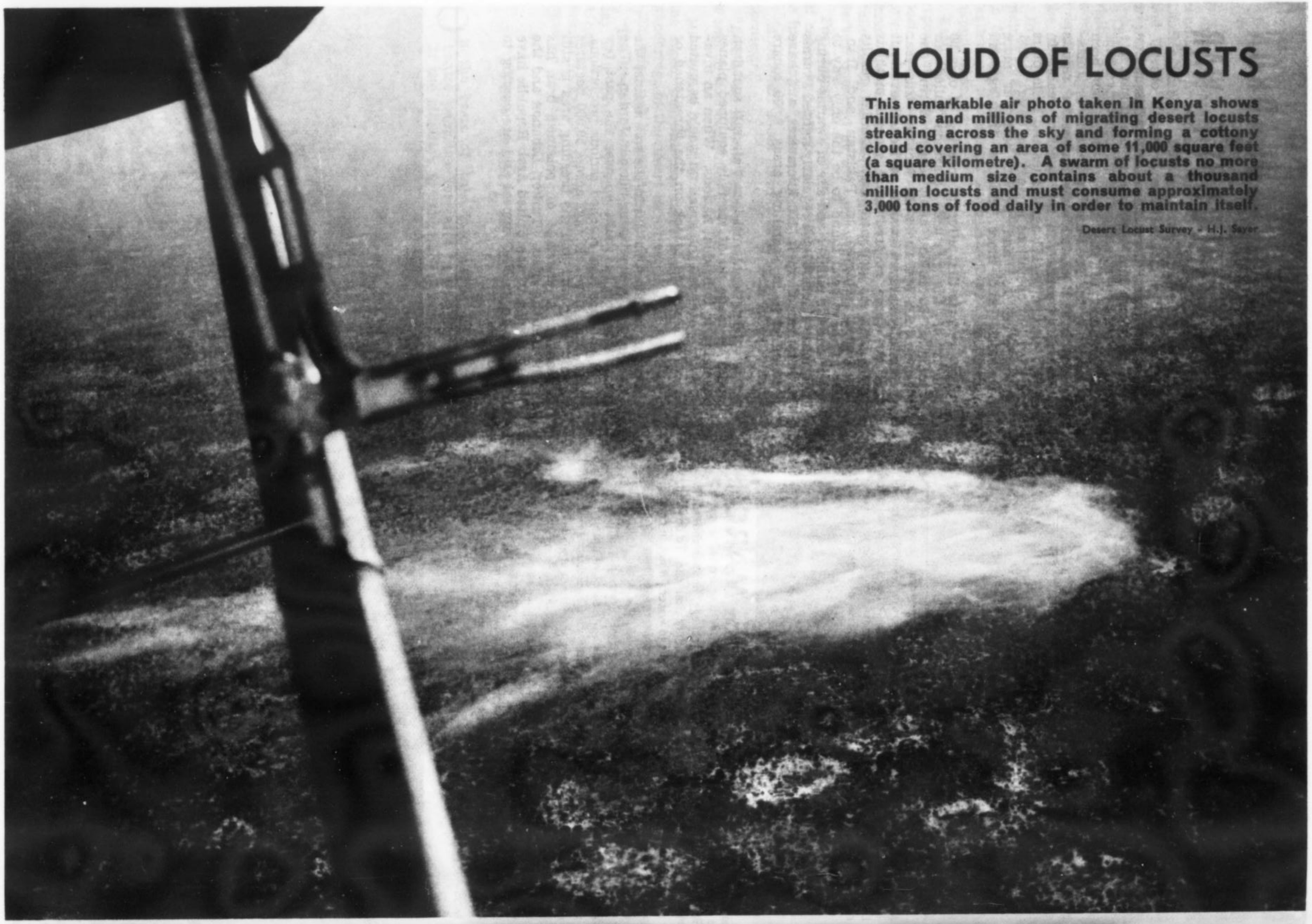
INT'L AIR SQUADRON IN ANTI-LOCUST WAR

An international anti-locust aircraft squadron may soon join scientists on the ground in a stepped-up attack on desert locust invasions. The creation of the aircraft unit has been proposed by the Food and Agriculture Organization of the U.N. following impressive results achieved by aircraft in the past few years. In 1957, for example, 171 aeroplanes and helicopters were used in operations against the desert locust in 23 countries, and proved both far more economical and more effective than ground techniques.

FAO reports that aircraft spraying of only 60 gallons of the pesticide diazinon killed an estimated 180 million adult locusts during one invasion. Air operations in Morocco this year successfully sprayed swarms of locusts at about half the price of traditional ground methods using bran as poisoned bait. Similar results have been achieved in Pakistan and Iran. Aircraft have been found to be the only way to determine the number and size of swarms during invasions. Aircraft have regularly sighted swarms at distances of up to 100 kilometres, and have been effective in searching areas 9,000 square kilometres in size.

The international anti-locust aircraft squadron would be made up of specially equipped planes belonging to individual nations. When an invasion alert sounded the squadron would be united in a concentrated attack on the threatened or infested area.

One of the latest battles in the war against the desert locusts is now taking place in Jordan. The locust invasion has built up over the past few weeks and has now reached serious proportions. The swarms have laid eggs across 50,000 hectares of cultivated land and the breeding area is still increasing. A shortage of poisoned bran has heightened the crisis. Turkey, Lebanon and the Syrian Region of the United Arab Republic have responded to an FAO appeal and are coming to Jordan's aid.



CLOUD OF LOCUSTS

This remarkable air photo taken in Kenya shows millions and millions of migrating desert locusts streaking across the sky and forming a cottony cloud covering an area of some 11,000 square feet (a square kilometre). A swarm of locusts no more than medium size contains about a thousand million locusts and must consume approximately 3,000 tons of food daily in order to maintain itself.

Desert Locust Survey - H.J. Sayer

They came They saw They conquered

Photos Anti-Locust Research Centre, London

Devastation caused by the desert locust is vividly illustrated in these three photographs. Top, healthy orange grove in the Souss Valley (Morocco) before a locust swarm spotted it. Centre, locusts form vast cloud blotting out trees and landscape as they swoop down on target. Bottom, orange grove stripped clean and soil nibbled bare after passage of marauders. A single swarm may range 3,000 miles and may number as many as 1,000 million locusts. In 1954 remnants of a desert locust swarm from Africa reached the British Isles after a flight of more than 1,500 miles over the open seas. A single locust weighs only a tenth of an ounce but a swarm can weigh 20,000 tons and must eat its weight in green food daily. Locust clouds leave not only ruin and despair in their trail but further potential scourges, for if the locust meets favourable weather conditions it breeds and lays eggs as it moves along—and another swarm is born.

Photo André Lestage

IS THE OCEAN IN DANGER ?

by Nicolas Gorsky

Member of the U.S.S.R, Geographical Society

THE amount of radio-active substances dissolved in the waters of the oceans and seas is infinitesimal. The rocks forming the Earth's crust contain a hundred times as much radio-active potassium as sea water and thousands of times more uranium. The radio-activity of the sediment at the bottom of the ocean is somewhat higher than that of the water above it. The concentration of radium in the iron-manganese concretions that form at the bottom of oceans and seas is relatively high, even higher than in the underlying sediment, but the mysterious source from which they derive radium has not been definitely established.

Manganese and radium are to a certain degree related and manganese apparently has the ability to extract radium from the sediment; it is a fact that there is always more radium on the bottom side of the concretion. Radio-active substances in the sediment are probably fission products of uranium, washed into the sea in solution by the rivers.

What must be borne in mind is that the highly diversified plant and animal life of the seas and oceans is accustomed to a very low concentration of radio-active substances. It is precisely from this quarter that a grave danger has arisen.

It has not yet been established what doses of radio-activity are innocuous for marine plants and animals. It is only known that fishes concentrate phosphorus and zinc in their bodies, while molluscs and crustaceans concentrate calcium, strontium and a number of other elements included in radio-active fission products.

Two days after atomic bomb tests at Bikini atoll, the radio-activity of the upper layer of water increased a million times over the normal. Four months later the radio-activity of the water 1,500 miles away was three times greater than the normal. In thirteen months the contaminated water had spread over an area of over one million square miles. The artificially caused radio-activity had decreased by this time until it was only one-fifth higher than the normal but it could easily be detected 2,500 miles away from the source.

How old are the deepest waters?

It is interesting to note the manner in which this radio-activity was dispersed through the ocean. Three long strips of high radio-activity were discovered: one stretched westward from the site of the explosion along the North Equatorial current, a second dipped away from the first to the southwest, while a third extended eastward in a direction opposite to that of the Equatorial current.

In the first and second strips, equal radio-activity was found at a distance of 2,000 and 1,000 miles from the atoll; in the third, the radio-activity at a distance of 750 miles was three times higher. In the case of the first strip the ocean current played the major role; the second and third strips are assumed to have been formed by radio-active dust borne by air-currents. According to Japanese scientists, the concentration of radio-active elements in the water after the explosion was considerably higher than the safety limit.

The immediate and urgent task confronting science is to study the dispersion of radio-active fission products, and their effect on marine life, both plant and animal.

Due to the rapid development of the atomic industry the problem of safely disposing of radio-active waste-products has become urgent. In Britain, radio-active wastes are in some places drained by pipes into the Irish Sea, while at Oak Ridge in the United States they are drained into the Tennessee River system. Some wastes in the United States are buried in the ground or sunk in the deep sea in special containers.

The sea water, however, will very quickly eat through the walls of these containers and dissolve their dangerous contents. Then, too, if scores, or it may be hundreds, of containers with their sinister contents are being thrown into the sea today, the number will rise to tens or even hundreds of thousands in the near future.

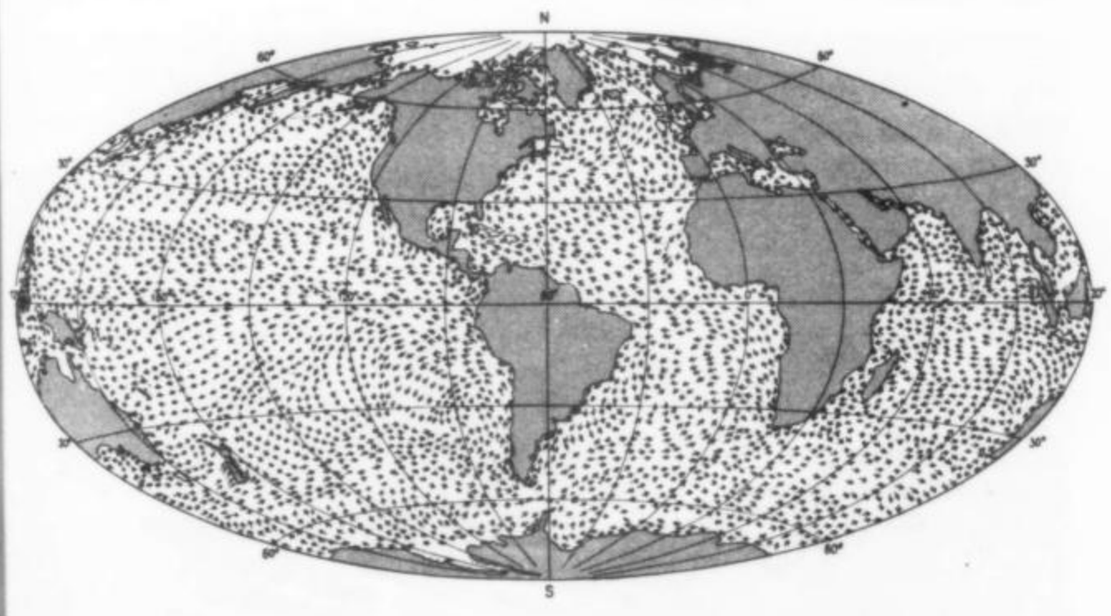
There are deep places or trenches in the oceans, particularly the Pacific. The average depth of the ocean is about two and a half miles, but in these depressions it reaches between four and five miles and in places up to seven miles. Proposals are being made to use these depressions as dumping-grounds for radio-active wastes.

This confronts oceanographers with the problem of determining the age of the waters in the ocean depths. Once purely theoretical, the question has now come to have great practical significance. How long will it take radio-active substances dissolved by the water at the ocean bottom to rise to the surface? Will the process of radio-active decay which is always at work render them innocuous before they reach the surface, or will they still be sufficiently radio-active to poison the upper, productive layers? It should be noted that the annual production of the sea-fisheries (fish, crustaceans and molluscs) comes to some twenty million tons, and that over half a million boats are engaged in the industry.

There is not a gulf or sea that is not connected with the oceans in a general system of water circulation. It is impossible to localize or isolate the poisoning of sea water. The map of the ocean currents on this page graphically illustrates this unity.

Scientists hold widely differing views as to the time required for the water at the ocean bottom to be renewed. Wüst (Germany) has calculated that the cold, heavy Antarctic waters, after descending to the depths of the Weddell Sea, reach the equator in five years four months, while Deacon (Britain) puts the figure at eighteen years. At the same time Worthington (United States) holds that the waters at the bottom of the Atlantic date back to 1810 when the climate became much colder, and have not been renewed in the century and a half that has elapsed since then.

The New Zealand oceanographers, Brodie and Burling, have put the age of the Antarctic waters 150 miles to the north of Scott Island at a depth of 8,500 feet at 2,500 years, and of the waters near Campbell Island at a depth of 2,624 feet at 1,900 years. The New Zealanders used the Carbon 14 method to determine the age of the water, but others hold that there are a number of factors besides time affecting Carbon 14, and accordingly that these conclusions must be accepted with caution.



THE OCEAN: AN INDIVISIBLE WHOLE. There is not a gulf or sea that is not connected with the oceans in a general system of water circulation (as map above shows). In other words, the oceans and seas are joined to form an indivisible whole—the World Ocean. It is impossible to isolate or localize the poisoning of sea water. When radio-active substances are introduced into the ocean at any spot they are dispersed for thousands of miles to contaminate an enormous area.

Oxygen miles down in the Pacific

The Danish expedition on the Galatea and Soviet expeditions on the Vityaz found dissolved oxygen in water from the very deepest Pacific trenches. It can be confidently stated that water buried at the bottom of the ocean for hundreds of years, let alone thousands, could contain no oxygen. It would be consumed in a much shorter time in various processes, both physico-chemical (the oxidation of mineral substances) and biochemical (the respiration of living organisms and the putrefaction of dead ones)—processes that are constantly at work at the bottom of the ocean and in the water above.

The Danish and Soviet expeditions discovered various forms of animal life at the bottom of the ocean trenches, which had till then been thought to be void of life. These animals included among others coelenterates, echiurides, goloturians and bivalve molluscs. All these animals consume oxygen continually and they would long since have exhausted the supply in the water round them if there were no currents.

What, then is the source of the oxygen at depths of up to seven miles? Up to now scientists have explained the aeration of the bottom layers of the ocean as being a consequence of the general circulation of the ocean

CONT'D ON NEXT PAGE

IS THE OCEAN IN DANGER? *(Continued)*

water. In the Polar regions the cold, heavy water submerges into the depths and slowly moves toward the equator, bearing with it the oxygen dissolved at the surface. But it takes scores of years for it to reach the equator. The dissolved oxygen could hardly be preserved for such a lengthy period—that is the weak place in the hypothesis.

Some oceanographers consider that oxygen is carried to the bottom of ocean trenches by turbidity currents. This is the term applied to the avalanches and landslides on the slopes surrounding the depressions. These are due to earthquakes or other causes, and as they plunge to the bottom of the depressions they carry along with them large volumes of water saturated with oxygen. But turbidity currents are only chance occurrences. In the intervals between them life at the bottom of the depressions should be extinguished for want of oxygen. This, however, has not happened during the millions of years that the ocean and its trenches have been in existence. Evidently the oxygen must penetrate to the depths of the ocean in some other way.

Professor N.N. Zubov, the Soviet oceanographer, recently suggested a new and more plausible hypothesis.

It seems that when volumes of sea water of different temperature are mixed, the density of the mixture is greater than either of the components. Being heavier than the surrounding water, it descends to the lower layers of the ocean carrying dissolved oxygen with it.

Perpetual motion in deep places

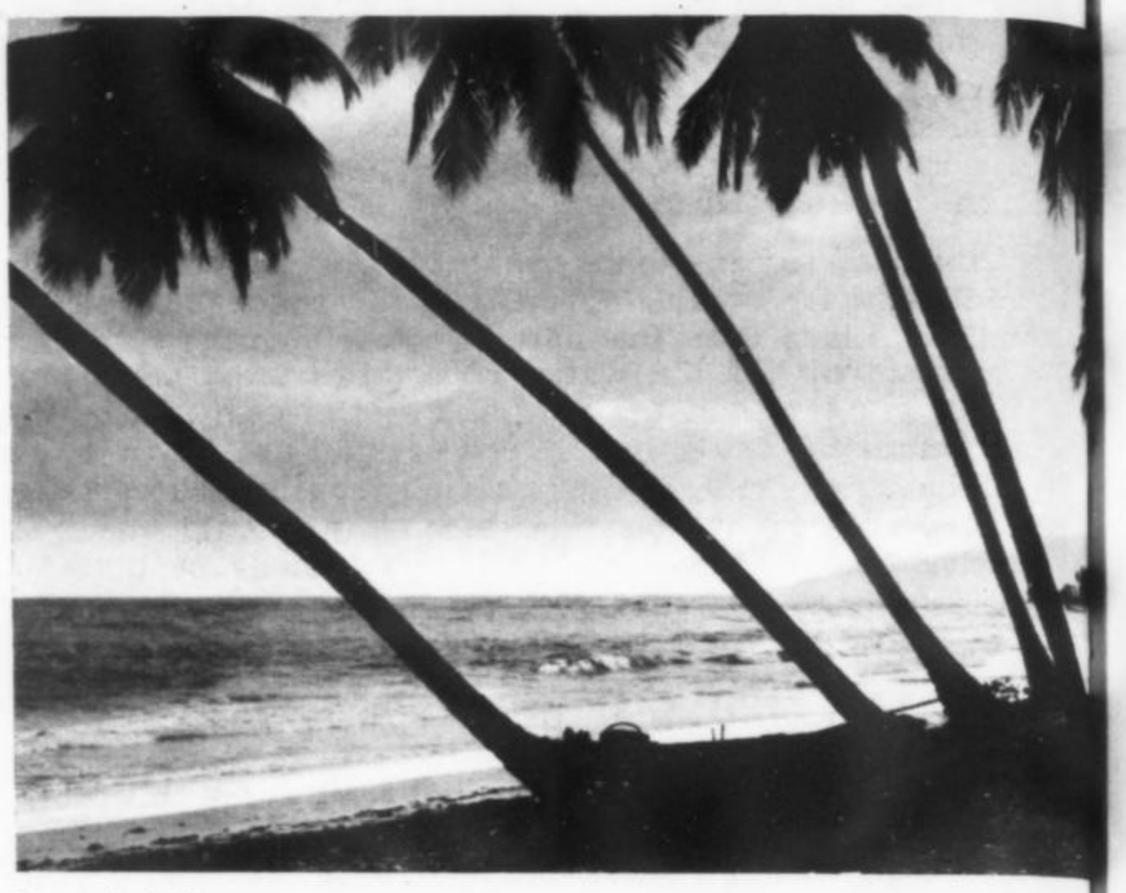
The water in the ocean is not homogeneous; its temperature varies both vertically and horizontally. What is more, the water in the ocean is continually in motion, neighbouring layers often moving in different directions. In this way water of different temperatures is being constantly mixed and is sinking as it becomes heavier. An equivalent volume of lighter water is displaced and rises to the surface. This eternal process extends to all the depth of the ocean, apparently penetrating to the bottom of the trenches.

We do not know as yet how long it takes surface water to descend to the ocean bottom, but evidently its movement is relatively rapid since it retains dissolved oxygen. Among the many depressions studied by this year's Soviet expedition on the Vityaz was the Tonga trench, investigated six years ago by the Danish expedition on the Galatea. Measurements made this year gave a difference of 0.2° in the temperature of the water.

When one takes into consideration the great accuracy of the deep-water thermometers used by oceanographers, one realises that this is a significant deviation indicating the existence of what is probably a very slow but continuous exchange of water between the bottom, intermediate, and surface layers of the ocean, even in the regions of the deepest depressions.

The vertical circulation which is a consequence of the mixing of the sea water and its increase in density, as described by Professor Zubov, ventilates the deep layers of the ocean and also raises to the surface a layer rich in nutrient phosphates and nitrates, forming a basis for abundant life. But this process will bring death if pernicious radio-active solutions from the waste-products of the atomic industry accumulate in the ocean depths.

In this connexion another phenomenon occurring in the oceans and seas should be mentioned—what is known as upwelling. Due to winds, currents or the relief of the ocean bed, deep, cold layers of water, rich in nutrient salts,



Photos André Lestage

rise to the surface in some regions along the continental slope or along submerged banks. This phenomenon is well known along the Atlantic coast of North America, the California coast and the Western coast of South America and Africa. The regions where upwelling occurs are exceptionally rich in plant and animal life, including fish. If the water rising to the surface should be contaminated with substances dissolved out of radio-active wastes it will mean the end of the highly productive fisheries in these regions.

The oceans and seas are joined to form an indivisible whole—the World Ocean. No open part can be considered isolated and cannot belong to any one country. Radio-active substances introduced into the ocean at any spot will be dispersed for thousands of miles and will contaminate an area of millions of square miles. For that reason, all questions concerning the contamination of the ocean by radio-active substances, irrespective of their origin or purpose, just as investigations into the effect of radio-active substances on marine life, acquire international significance and should be solved through friendly, concerted international scientific co-operation.

The rate at which the atomic industry is developing shows that it is necessary to set about the study of this problem immediately. Uncontrolled contamination of the oceans and seas can lead to irreparable catastrophe within ten to twenty years. The Ocean, that great and inexhaustible source of food for man must be protected. The Ocean is in danger.

A DESERT IN THE HEART OF LONDON

(Continued from page 24)

THE GRASSHOPPER & THE LOCUST: DR. JEKYLL & MR. HYDE OF INSECTS

"We have a budget of only £70,000 a year," Dr. Uvarov pointed out. "If we tried to do everything ourselves we would get nothing done. So we encourage others to help us by supplying them with research grants and raw material—that is, locusts."

With a twinkle in his eye, he added: "Why we even send locusts to laboratories in Rhodesia and Ghana—it's more practical to write to us than to try to catch them out-of-season.

In the laboratory, under the direction of Mr. Philip Hunter-Jones, desert locusts are raised under conditions as close to normal environment as possible. They are bred in constant-temperature rooms where the thermometer always stands at 29 degrees C., laying their eggs in small tubes of moist sand. They are fed on succulent grass—which often raises a food supply problem in the middle of an English winter.

The desert locust needs moist sand to lay its eggs and this characteristic is worrying scientists as they watch the spread of irrigation in semi-arid lands. In certain cases, and at great expense, man seems to be unwittingly creating new locust breeding grounds.

Locusts' 'rain-sense' myth exploded

WITH the help of its laboratory and the world's biggest library on locusts, the centre has been able to explode a number of myths concerning the desert locust and is now exploring certain characteristics of this insect which may hold the key to its ultimate control.

Dr. R.C. Rainey, a "biometeorologist" (that is, a biologist and meteorologist) is one of the men responsible for shattering some of the myths. His studies both in East Africa and at the centre have explained much of what used to be called "the psychology of the locust."

Popular belief once held (and often still does) that desert locusts move with unvarying intent and purpose, and that they are even capable of sensing rain from a distance in the desert, swarming down at the right moment to eat the plants it produces.

But studies of swarms both from the air and with cameras on the ground show that locusts consistently move downwind at a speed equal to or less than the speed of the wind (their own flying speed is from 10 to 12 m.p.h.).

Actually, Dr. Rainey stated, the individual locusts fly in all directions, making it impossible for a man on the ground to tell in which way the swarm as a whole is moving. The swarm's course is exactly like that of an aeroplane pilot who is lost: he flies around in circles but his position changes because he is drifting with the wind.

This downwind movement often takes the locusts into what meteorologists call "areas of convergent wind flow" which can produce rain in arid regions. That, in Dr. Rainey's opinion, is how desert locusts "find" rain.

According to another old belief, locust swarms fly when the barometer drops, but the centre's research has shown that atmospheric pressure has nothing to do with flight. "The locust can only take off when its muscles are warm," Dr. Rainey explained. "At a temperature of about 25 degrees C. (77 degrees F.), its 'engine' is warmed up for flight. The atmospheric pressure often drops in arid regions when temperature rises and that is why people once thought the barometer had something to do with the flying of swarms."

Meteorology has also provided the answer to the astonishing heights reached by desert locusts. Aircraft have sighted them flying at 10,000 feet and some have been seen on mountain passes 20,000 feet above sea level. In this case it is the powerful convection currents from the desert which send them spiralling upward.

As for the biological side of biometeorology, Dr. Rainey is studying the insecticides used against the desert locust. These insecticides must be powerful enough to kill tons and tons of locusts and yet at the same time do no harm to plant and other animal life.

Insecticides involve the study of the physiology of the locust—one of the most fascinating aspects of the London centre. It is carried out under Dr. Peter T. Haskell, a young scientist who works in a room filled with electronic apparatus capable of measuring such things as the smell, eyesight and hearing of a locust. There is even a "wind tunnel" for flight-testing.

Dr. Haskell and Mr. Hunter-Jones are attacking different aspects of the problem of why desert locusts swarm. This is one of the most puzzling metamorphoses of nature. If left alone, the species is an ordinary green grasshopper. But, in a crowd the relatively inoffensive grasshopper becomes the gregarious, predatory desert locust. Its colour turns to yellow and black, its wings lengthen and its head thickens.

No differences explaining this Jekyll-and-Hyde conduct can be detected when a locust and a grasshopper are dissected and examined under a microscope. Dr. Haskell suspects that there must be some aspects of the desert locust's central nervous system which causes it to seek the company of other locusts and to form a havoc-making swarm.

In his research, he uses some rather amazing devices. One, for example, which could be called a locust-tickler, was developed by Dr. Peggy E. Ellis, a member of the centre working at Oxford. It consists of a jam-jar with an electrically driven wheel bearing rope fibres turning inside it. The fibres stimulate the tactile organs of a young locust in the hopper stage and, so far, the experiments show that exciting its sense of touch seems to make it more willing to seek the company of other locusts.

Infra-red lamps warm the desert

DR. HASKELL also rules the only artificial desert in London. It is a flat wooden tray about ten feet square with a sand floor an inch thick. Two infra-red lamps beat down through its glass roof while wind is created by an electric fan. This artificial desert has already demonstrated that young hoppers are quite capable of finding grass by their sense of smell. It also shows that they congregate in still air and disperse in a wind.

With all these weapons, the centre has hopes of solving the desert locust problem—but not overnight. Basic research must first give science the explanation of the dreaded insect's life before control measures can be taken.

Dr. Uvarov is cheered by a precedent. A team from the Anti-Locust Centre spent five years in Cyprus studying the so-called Moroccan locust. They learned that the insect flourished on overgrazed patchy terrain because it needs bare soil to lay its eggs and grass for food and shelter. On this basis, the centre was able to recommend a moderate control of grazing to eliminate the locust's grassless breeding grounds.

"The locust will be there but it will not swarm," said Dr. Uvarov. "And that is what we are trying to do with the desert locust as well. We will succeed if we have the time. Even if we had unlimited money and equipment at our disposal, we would still need time. There are no shortcuts in science."

Letters to the Editor

NEGRO DANCES & CUSTOMS

Sir,

I want to make a humble protest against so much lauding of the Negro races. They have great values, and must be treated with equal opportunities and I know we must do them justice in every way. But to pretend to see spiritual values in all their dances and in some of their revolting habits and customs is going too far.

E. Picton-Tubervill
Cheltenham, England

BREAKING LANGUAGE BARRIERS

Sir,

...Language still continues to be the chief barrier standing in the way of the peoples of the world coming together. May I, therefore, suggest that THE UNESCO COURIER give greater attention to the major languages of the world? Articles to stimulate interest in the study of languages should be published in every issue of this magazine. Linguistic habits and customs, parallels and peculiarities, famous books from different languages and similar subjects would go a long way in bringing closer the nations of the world.

D. Viswanadha Babu
Vizianagram, Andhra, India

THE RIGHT APPROACH

Sir,

I am a student, and although I only recently made my first acquaintance with THE UNESCO COURIER it has already added to my understanding of many things. I was especially pleased with the issues devoted to the International Geophysical Year and to the Brussels World Fair. I also enjoyed those telling about the drawings of famous writers, the archaeological findings in Mexico, and the ancient art of Ceylon.

Your publication offers much to those interested in art and ethnology. I disagree with those readers who have asked you to publish more "specialized" and "scholarly" articles. I believe the purpose of the magazine is best served by the type of article it now prints. I find the illustrations excellent and should like more of them—they liven up the text.

S.V. Lashin
Krasnodar, U.S.S.R.

INTEREST REVIVED

Sir,

May I congratulate you on the December 1958 issue of THE UNESCO COURIER. I must say that my interest in the magazine had waned because for a few months, it was rather boring to read save for an odd article. Anyway the December 1958 issue has ended with a more appetizing flavour... Special mention must be made of articles re "The Orient Today and Yesterday," "All Men are Brothers" and "The World is Sick of Hatred." I certainly enjoyed reading them.

Olga M. Stephens
London, England

SCIENCE HAS A PURPOSE

Sir,

I was very much interested in the speech made by Bertrand Russell on receiving the Kalinga Prize for 1957 (February 1958 issue), but I beg to differ with Russell when he says that "At present, scientific technique advances like an army of tanks that have lost their drivers, blindly, ruthlessly, without goal or purpose." That is not so. There is both a goal and a definite plan for achieving it. It seems to me that if nature, "working" without a plan and in a laboratory as imperfect as our planet, has been able through countless numbers of experiments (as Darwin has pointed out) to produce as complicated a mechanism as the human brain, human beings armed with plans and the latest achievements of science will be able to produce a life of plenty for all peoples on the earth.

A. Khizh
Moscow, U.S.S.R.

EACH ONE REACH MANY

Sir,

I read with interest your appeal for new readers in the June issue of THE UNESCO COURIER. Please find enclosed a cheque for £4.0.0 together with the names of eight new subscribers. I find great satisfaction in doing this, knowing that perhaps I am contributing to foster understanding among people and I would like to continue to increase the number of readers.

A. Martinez
Chelmsford, England

ART & ABNORMALITY

Sir,

The May number of THE UNESCO COURIER is extremely interesting. The care and cure of mental patients is an urgent need, and the progress made is impressive.

However, one sometimes wonders if the psychiatrists are not creating their own patients. We have learnt to accept maladjustment as the new explanation for bad behaviour, and we struggle to comprehend the jargon of psychiatry. But the explanation given of the child's drawing on the back cover is straining credulity too far. The turnip-headed little creature on a tightrope could surely have been drawn by any normal child? One wonders what this psychiatrist would have said of the child who made a drawing of a policeman, with blue helmet and tunic, and bright yellow buttons, but no feet. Obviously a subconcious fear of the law as symbolized by those slow, sinister, tramping feet. The child's explanation was much simpler. He had no black chalk!

Elinor D. Rhodes
Faversham, England

BRICKBATS & BACK PATS

Sir,

... I am afraid I expected something definitely more educational than I found in the issues received by me for last year. It seems a pity that with the wonderful opportunities UNESCO has that they have not produced a magazine of greater value.

M. J. Clarke
Port Elizabeth, South Africa

Sir,

Congratulations on the high standard of quality of the articles you publish and also on the fine photographs which illustrate them.

Jeanne Bouet
Paris, France

Sir,

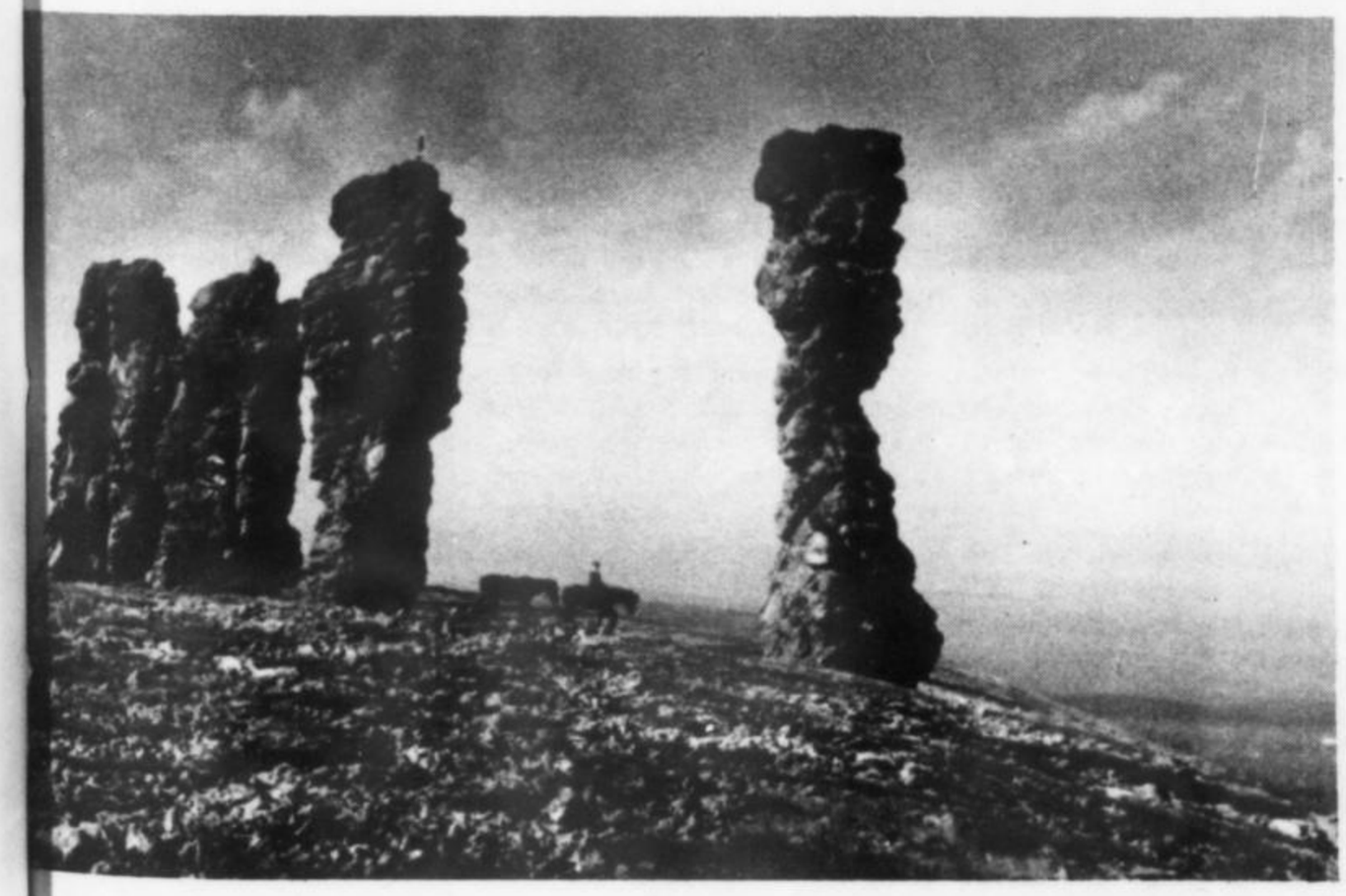
I have the feeling that your magazine is less interesting than it used to be when I first became a subscriber. I would like to find in it fewer scientific articles and more reports about everyday life in all countries written in a simple style, thus making the reading of it a pleasure and not a chore.

E. Boudot
Nantes, France

Sir,

I get the greatest satisfaction from reading your magazine each month. One recent article, in which deserved tribute is paid to Mahatma Gandhi, is a case in point, for in our epoch of upheavals, starved of moral awareness, constantly threatened with a shattering of the peace which *he* so ardently desired, you show us a most extraordinary personality, one most worthy to be known by the whole of humanity.

Gladys Viola
Rosario, Argentina



NATURE'S INVENTIVE GENIUS IN STONE

Sir,

In the summer of 1957 I set out to make a film on the subject of erosion. In the Crimea, the Caucasus and the Urals, particularly on the banks of rivers like the Petchora and the Tchussovaya, I came across the most extraordinary stone statues with forms as striking as they were varied. But it was not the hand of a sculptor which had shaped these bizarre monuments; it was Nature herself—water, variations in temperature, the wind, the erosive action of glaciers—which over millions of years had gradually produced them.

The most remarkable of these stone forms are found in the northern Urals, on the mountain where the Petchora River has its source. They have strikingly different shapes, which are completely transformed according to the angle from which they are seen.

I was particularly struck by a group of seven great stones, for all the world like petrified giants. Close by, another rock rose up in the form of a lion's head complete with mane and not far off was a great mass of rock looming up like a medieval fortress, its summit, viewed from another angle, recalling the shape of a crouching camel.

Nature has embodied much that is artistic in these age-old works. But this is not the only reason why I believe these natural monuments should be preserved and protected from the elements—and from man's negligence. These "stone mysteries" have a great scientific importance for they will aid future generations of geologists to understand and write the history of the earth, deepen our knowledge of the process of erosion and also help the discovery of veins of useful or valuable materials such as marble, iron, coal, gold, platinum to name but a few.

It is not only possible, but also very vital to preserve these natural monuments which are certainly to be found in great numbers around the world, and an active campaign aimed at this work of protection should be launched.

M. Zaplatine.
Moscow U.S.S.R.

From the Unesco Newsroom...

ANNIVERSARIES OF GREAT MEN: This year, UNESCO will give its patronage to celebrations marking Chekov's centenary and to cultural events in Poland commemorating the 150th anniversary of the birth of Chopin. It will also help to organize a symposium on the work of Darwin to mark the 100th anniversary of the publication of "The Origin of Species". UNESCO will also invite its 81 Member States to associate themselves with the celebration of other anniversaries that fall in 1959-1960 —those of Shalom Aleichem, Henri Bergson, Pierre Janet, Franz Josef Haydn, Alexander von Humboldt and Friedrich von Schiller and will itself publish and distribute articles and prepare sound recordings, radio scripts and filmstrips devoted to these anniversaries.

■ **U.S. AND U.S.S.R. ARRANGE YOUTH EXCHANGE:** *Seventy-two American and* 24 *Soviet young people are due to participate this year in the second exchange of youth groups between the U.S.A. and the U.S.S.R. under an agreement between the Council on Student Travel, New York and the Soviet Committee of Youth Organizations. This provides for the Americans to spend* 40 *days in the U.S.S.R., including vacations in summer camps and visits to Moscow and Leningrad, meeting young people, interviewing youth leaders and sight-seeing. The Soviet group will arrive in the U.S.A. in October for* 30 *days of visits to colleges and American homes.*

ENERGY-HUNGRY WORLD: World consumption of commercial energy has about doubled in the past twenty years reports the International Labour Office. As the world's population has increased during the same period from an estimated 2,000 million to 2,740 million, per capita consumption has therefore risen by about 44 per cent. Other facts from the report: petroleum is now the principal competitor of coal, followed by natural gas, and hydroelectric power; nuclear power will play a significant role in the future, but so also will other sources—solar energy, wind and tides—at present only playing relatively minor roles.

■ **$10 MILLION AID FOR THE WORLD'S CHILDREN:** *Assistance for the world's children totalling over* $10 *million was approved recently by the Executive Board of the United Nations Children's Fund* (UNICEF). *This represents about half the total* UNICEF *aid planned for* 1959. *The rest will be allocated in the autumn. The money will be devoted mainly to general disease control* (42%) *nutrition* (41%) *and basic maternal and child welfare* (17%) *in programmes which will benefit fifty countries and territories.*

AUSTRALIA'S ASIA WEEK: The International Club of the University of Western Australia recently arranged an Asia Week in Perth and as a follow up sponsored a 1,350-mile tour of the State's country districts in which seven Asian and ten Australian students combined their efforts in a campaign to tell Australians about Asia. The Asian students—Colombo Plan scholars from Burma, Indonesia, Malaya, Singapore and Thailand—lectured at schools, talked to public organizations and made broadcasts over local radio stations.

■ **CUBA'S EMERGENCY CLASSROOMS:** *The Government of Cuba recently launched a campaign aimed at finding* 5,000 *temporary classrooms. Farmers have been asked to lend to local education committees, houses, barns and store-rooms where classes can be held until new schools are built. As soon as temporary accomodation becomes available, the Ministry of Education sends a teacher with the necessary equipment to turn it into a classroom.*

POLISH ART GOES HOME: Some of Poland's most historical art treasures which were taken from the country on the outbreak of war for safe keeping abroad have now returned to their original owners —the National Museum of Warsaw, the Polish National Library, the Gallery of Wawel Castle in Cracow and the library of Pelplin Seminary. Items from these collections include the coronation insignia of the kings of Poland—in particular the famous "Szczerbiec" (Jagged) Sword—historical manuscripts and early printed works including a Gutenberg Bible, works of medieval and Renaissance craftsmen as well as some of Chopin's manuscripts and letters.

■ **COLOMBIA FIGHTS TO WIPE OUT ILLITERACY:** *A ten-year campaign to wipe out illiteracy has been launched by Colombia. School teachers and all persons holding diplomas as well as priests in every parish of the country have been asked to help. The government plans to eliminate illiteracy by* 1969. *At present an estimated three million out of a total population of nearly* 11,500,000 *are illiterate in Colombia.*

GEOTHERMAL ENERGY FOR THE U.S.S.R.: Construction of the first geothermal power station in the U.S.S.R. has started in the Baudjedka Valley area of southern Kamchatka (Soviet Far East). The station will run on underground steam which is plentiful in areas of volcanic activity. Steam resources on the volcano-surrounded Baudjedka Valley are believed to be practically inexhaustible. Wells are now being drilled on the construction site through which steam will pass to reach the turbine blades. The station will take two or three years to complete.

FOUR-LEAF CLOVER

We apologize to readers for an error made by our printers in the last issue. A caption on page 9 *was inadvertently repeated on page* 8. *The page* 8 *caption should have read "Four-leaf clover design solves road junction traffic problems on one of the motorways near New York. This is a classic formula used at a simple intersection of highways, allowing one stream of traffic to cross or change direction without having to cut through other traffic lanes."*

Nations to help in preservation of monuments menaced by Aswan Dam

THE United Arab Republic has asked Unesco for international aid to help preserve historical treasures in Nubia which are destined to be swallowed up by the Aswan Dam on which work will begin at the end of this year. A few years from now a huge lake created by this dam will irrigate much of Upper Egypt, but when this happens monuments as irreplaceable as the temples of Abu Simbel, Debod and Kalabchah will be inundated by a man-made flood.

Egyptian authorities have already made plans to conserve this artistic and cultural heritage. Since 1955, a Documentation and Study Centre for the Art and Civilization of Ancient Egypt, set up with Unesco's help, has been preserving, through photographs, drawings, copies of paintings and plaster casts, the sanctuaries of Rameses II.

A plan under which Unesco would prepare a detailed programme of operations to be carried out, if necessary with the help of a special fund supported by Member States, was presented recently to Unesco's Executive Board. It calls for preliminary studies to be completed by the autumn.

Unesco is now to call a meeting of experts to decide how the work should be done. A photogrammetric survey of the region will be made in August or September and the experts will then estimate the cost of the programme so as to set a figure of contributions by Member States. The plan as a whole was approved by Unesco's Executive Board which will discuss at its next session the experts' report and that of Unesco's Secretariat concerning the preliminary work to be carried out.

Imp. GEORGES LANG, PARIS. IMPRIMÉ EN FRANCE.

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1860 - 1959

(5th revised and enlarged edition)

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WAR ON LOCUSTS

FAO

The world's desert locust zone is an area covering no less than 11 million square miles of territory, englobing 65 countries and territories on three continents. The battle against this age-old plague is now organized on an international scale, and a large share has fallen to the United Nations. As a last resort, when preventative measures have not been taken in time, swarms have to be attacked on the ground with poison bait. Above, poisoned bran being sown during an invasion in Morocco. Below, handful of dead locusts, picked up from the thousands littering the ground after the sowers have passed, shows effectiveness of such campaigns. (See page 22)

UNATIONS

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SEPTEMBER
1959
(12th year)

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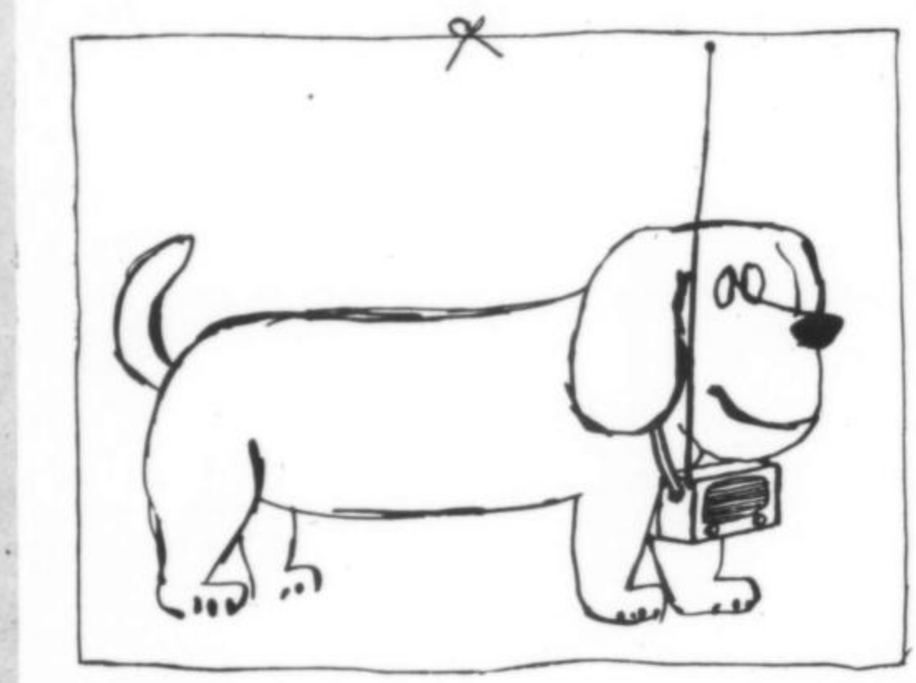

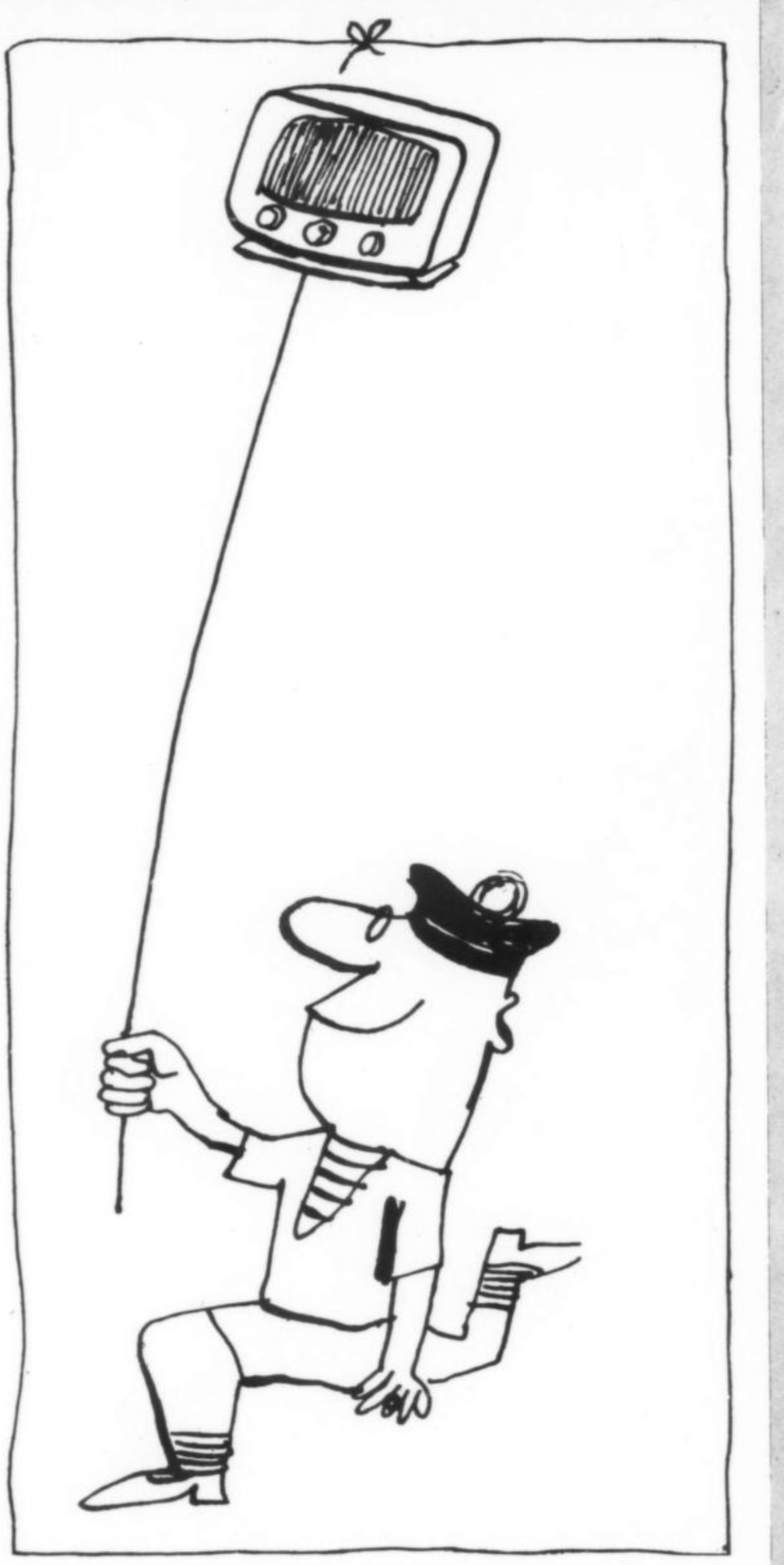

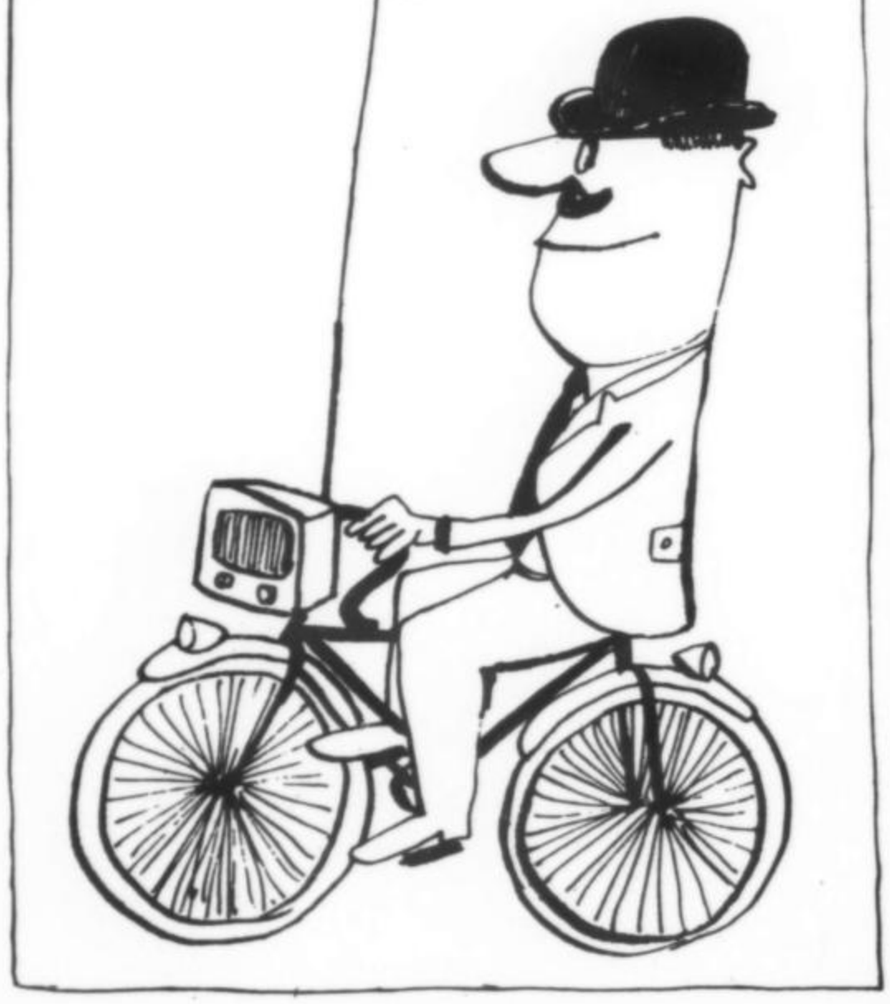

The UNESCO Courier
A WINDOW OPEN ON THE WORLD

SEPTEMBER 1959
12TH YEAR

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BBC, London

COVER PHOTO

Since 1955 radio sets have outnumbered copies of daily newspapers sold around the world. Radio receivers now number an estimated 350 million and newspapers under 300 million. Photo shows Hisato Okuse, " Miss Japan 1958 ", speaking from the BBC, London to listeners in the Far East. With 90 transmitters and 15 million receivers, Japan is now one of the world's major broadcasting countries. The Japan Broadcasting Corporation is rapidly developing closed circuit radio among farming and fishing communities and plans to cover all Japan with a frequency modulation service within five years.

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FREEDOM TO LISTEN

by George A. Codding Jr.
University of Pennsylvania

JUST four short decades ago, the voice of broadcasting was little more than a whisper coming from half a dozen experimental stations in Europe and America operated by men inspired by an idea and a hope. A small but equally devoted band of amateurs, who had painstakingly created their own primitive receivers, were the only ones to hear that whisper. Good music and up-to-date news were not the objective for which these individuals searched, but simply a few spoken words or a snatch of unidentifiable music being hurled miraculously across space.

Today broadcasting is one of our most important means of mass communication. Over 9,000 transmitters and more than 300 million receivers are available to bring the voice of broadcasting into the lives of mankind. Radio is an instantaneous and efficient method of keeping people informed of important events no matter where they occur.

The listener in Japan can have reports of a top-level conference over his local station in the time it takes for interpretation and translation of the proceedings directly by short wave from the United Nations building in Geneva. The sports fan in Argentina can follow the progress of his soccer team just as easily whether it is playing in Buenos Aires or at the Olympic games in Melbourne. It is also an inexpensive way of bringing the world's greatest music and drama directly into the homes of a widely scattered and heterogeneous audience.

Above all, radio is the ideal instrument for promoting the free exchange of ideas and attitudes between nations and their peoples. European listeners, for example, can pick up broadcasts from several neighboring countries with a normal type of medium-wave set. With a slightly modified receiver, they also can receive short-wave broadcasts of talks and commentary directly from the far corners of the globe. So important has broadcasting become that the nations of the world have affirmed through the United Nations and UNESCO that freedom to listen is an essential corollary to man's right to freedom of opinion and expression.

Different countries have adopted different methods of bringing the advantages of broadcasting to their peoples. In the United States and most of South America the free enterprise system is in common application for domestic needs. Government interference is kept to a minimum and the competitive spirit is relied upon to provide a varied programme fare. Radio is financed by the sale of time to advertisers.

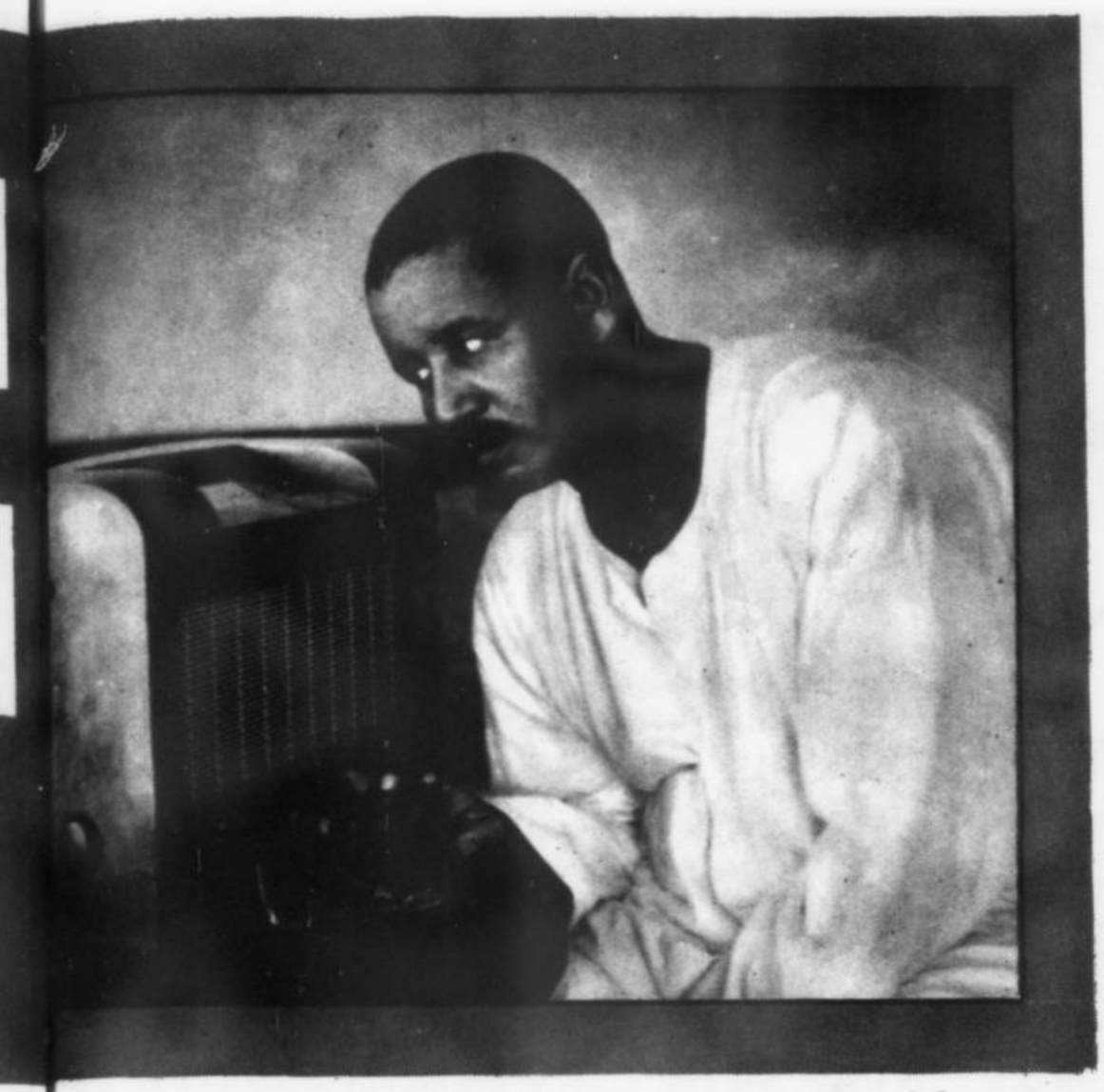
In most of the rest of the world broadcasting is regarded as a public service. The authorities seek to enable everyone to listen to one, two, or three national programmes of varied content. In order to bring some broadcasting to every citizen, there is a tendency to establish a fairly comprehensive coverage throughout their territory, even if some of the stations would be "uneconomic" by commercial standards. The cost of the service is met by license fees on receivers, reinforced where necessary by government appropriations.

Bigoted propaganda machine or source of unbiased news

SOME countries, like Canada, use a combination of the two systems in order to ensure that there will be both adequate coverage and certain cultural standards in a variety of programmes. Broadcasting for foreign consumption, on the other hand, is almost exclusively a state function, whether only a few hours of programmes are transmitted per day, as in the case of Iceland and Thailand, or whether the external services operate "around the clock" as in the case of several of the larger countries. Responsibility is usually shared between the foreign affairs branch of the government and a governmental operating agency, and the expenses are met by state grants.

No matter what system is used, the pervasiveness, immediacy and intimacy of radio place a heavy burden on those who control its use. By design or accident broadcasting can be turned into a wearisome, bigoted governmental propaganda machine, or it can be used to present unbiased news and to help the listener to understand his neighbour's problems. It can also be transformed into a mere outlet for "popular" music and singing commercials, at best just another background noise of modern civilization, or it can be used to widen cultural horizons and to aid in educational advancement. Constant vigilance is necessary to keep broadcasting from sliding into either of these undesirable extremes.

There are several serious obstacles—economic, technical and political—that impede the most effective use of broadcasting and thus deny far too many the freedom to listen. Probably the most important is the lack of success in making broadcasting facilities, especially receivers, available to all parts of the world. While Europe and



North America have a fairly adequate distribution of receivers—half of the world's total being in the United States alone—and South America is in a relatively good position, the condition is still shocking in many parts of Asia and in most of Africa.

In Asia, with the exception of certain countries bordering on the Mediterranean in the west, and Japan and the Philippines in the east, the average number of receivers per 100 persons rarely exceeds six, and in some areas there are less than one per 100 inhabitants. In Africa, with the exception of Algeria, Egypt, Morocco, Tunisia, and the Union of South Africa, few countries have as many as one receiver per 100 inhabitants.

It is important to note that the areas which do not have adequate broadcasting facilities are those where the need is the greatest. While lack of adequate transportation may make it difficult or even impossible to distribute newsprint, books or film, radio can communicate over long distances despite mountains, rivers, and jungles. Broadcasting can also overcome economic barriers that exist in most underdeveloped countries. After the costs of installation have been met, the maintenance of a broadcasting service is relatively inexpensive in relation to the area that it can cover and considerable use may be made of local resources. Film and newsprint, on the other hand, are expensive and must be purchased from abroad in the currencies of the major producers. The third and most important advantage of radio is that it can inform and educate whether or not the listener is literate. As UNESCO has pointed out, the countries which are poor in information media are also those where the level of illiteracy is the highest.

The expansion of broadcasting to meet the needs of underdeveloped areas, and perhaps even its continuation on the same level in more fortunate areas, depends upon the solution of another basic problem. The radio spectrum is used by many services in addition to broadcasting—ships, aircraft, telegraph and telephone, and amateurs, to mention but a few—and new ones are being introduced. Since the radio spectrum is limited, and the appetites of the radio services are not, over the years it has become more and more crowded especially in some of the more desirable frequency bands. The interference between stations that has resulted is so serious in certain bands that the future of broadcasting as well as other radio services is actually in serious danger.

One possible remedy has been explored by the International Telecommunication Union (ITU), the world's guardian of the radio spectrum. At its first post-World War II conference in 1947, it decided to draw on the experience of the European broadcasters and establish a world international frequency list in which all available frequencies would be assigned to countries on the basis of their individual needs. In addition, an International Frequency Registration Board was to be created with the duty of assuring that any future operating changes would cause no interference to the stations operating according to the new list.

After eleven years of exhaustive labour in which the technical representatives of almost every country met time and time again, the ITU still has not reached the objectives set for itself. Limited success was obtained in assigning frequencies in the low and medium bands where most domestic broadcasting is carried out, but there was almost complete failure in the bands with long-range propagation characteristics, especially those used for broadcasting directly from one nation to another. The reason lay in the fact that the total requirements submitted greatly exceeded the spectrum space available. Some requirements were most certainly legitimate but others were exaggerated in the hope that a minimum would remain after bargaining; still others were inflated to provide for any possible expansion in the future.

The position of high frequency broadcasting was further complicated by the division of responsibility in most international services between the telecommunication or broadcasting authorities responsible for programming and operating and the non-technical and political government departments which oftimes decide the areas to be covered, the languages to be used, and the times

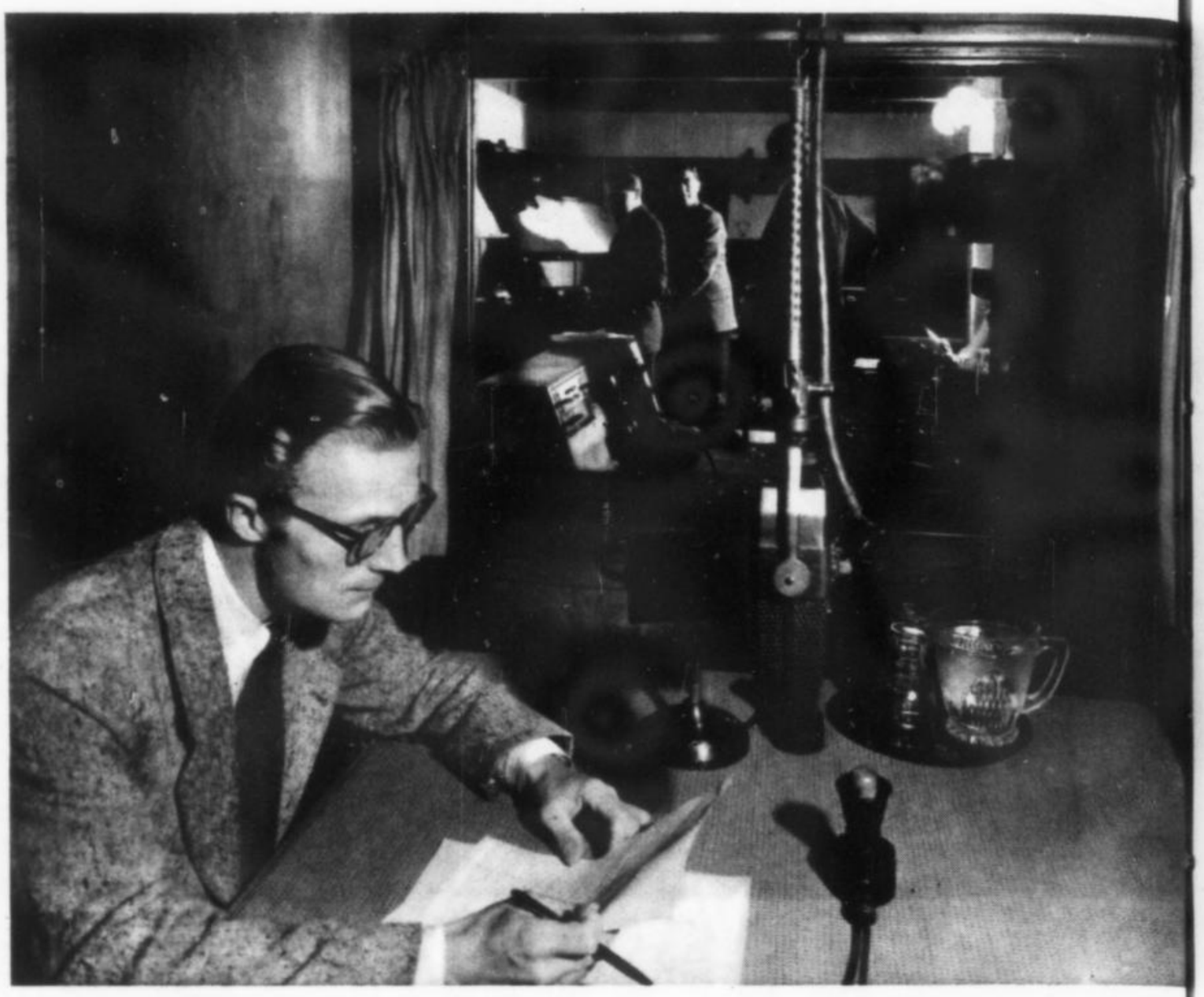
CONT'D ON NEXT PAGE

© BBC, London

INSIDE VIEW of a soaring radio mast at the British Broadcasting Corporation's Very High Frequency transmitting station, near Norwich, England. The Very High Frequency Band has only come into large-scale use for broadcasting within the last ten years. All frequency modulation stations, and most television stations operate within this band.

FREEDOM TO LISTEN

(Continued)



STUDIO DEADLINE. Announcer gives last minute look at news script while producer and scriptwriter check production readiness in control room seen in background.

© BBC, London

of transmission. Whatever the reason, the countries of the world have so far failed in this endeavour. Fortunately, another opportunity to reach agreement will present itself when the nations of the world meet this fall in Geneva for the second post-World War II ITU Administrative Radio Conference. (See page 8.)

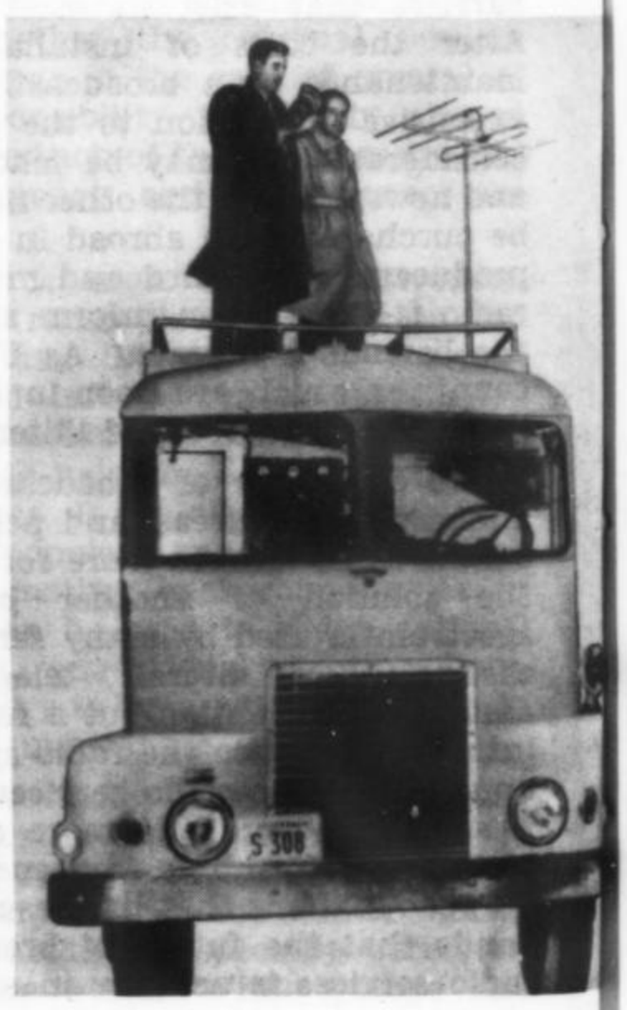
There is another approach to the technical problem of radio which can perhaps aid in the quest for a political solution: frequency spectrum conservation. If the limits of the desired frequency bands cannot be enlarged, the frequencies available should be used in the most effective manner. Many radio services have found the means of reducing the frequency space used by their transmissions to permit a greater volume of traffic within their allocated bands through time sharing, geographical sharing and the introduction of new technical methods such as single side band emissions.

An excellent example is the short-range mobile services employed by fire prevention, police, public utilities, taxis and other similar organizations. In the past few years the spectrum requirement for one channel of the mobile service has been reduced by a quarter and equipment has been developed that may permit a further reduction of one half, or even one sixteenth of what was previously considered necessary.

Of all the radio services, broadcasting has perhaps done the least in this respect. Even if it is conceded that the special nature of broadcasting has prevented such action in the past, the perfection of frequency modulation (FM) broadcasting in the very high frequencies opens the door to an effective contribution. In 1947 the ITU assigned an additional band to broadcasting in the newly developed very high frequency area of the spectrum. Later it was found that the use of the FM technique on

PROPHET OF THE 'ELECTRIC' AGE

In the 1880's Albert Robida, French artist-writer, amused his readers with imaginative pictures of the "Electric Age" which in reality bears strong resemblance to the 20th century's "Electronic Age". In his drawings, Robida depicted such modern developments as television entertainment, television advertising, radio news broadcasts and music recordings. A far-seeing drawing by Robida (right) showed a news correspondent broadcasting an eyewitness report to a distant audience from the back of a camel via radio. Today Robida's dream is an everyday event with the camel replaced simply by the mobile broadcasting units and staffs of roving radio reporters (far right).



USIS photos

these frequencies provided the man at the receiver with clearer and better listening and there was a decided reduction in the possibility of interference from other transmitters operating on or near the same frequency.

If very high frequency FM broadcasting could be introduced wherever practicable throughout the world for local broadcasting needs, as it is being done in some countries in Europe, the medium waves could be made available for national coverage and even intermediate range international broadcasting. This in turn could free many of the high frequencies, which are now being used for national or medium range international broadcasting, for their proper use as long-range services. The savings that could result from such a procedure could relieve much of the present pressure in the medium and high frequency bands, thus contributing materially to solving the frequency problem as a whole.

If broadcasting does not find a method of giving the listener the service that he desires and deserves he may turn to a competitor such as wired broadcasting. Basically, this service consists of picking up broadcast programmes from a central point or exchange, and distributing them by wire to those subscribing to the system. The principal advantages claimed by the wire broadcasters cover most of the situations where regular broadcasters are failing in their duty to the listener. There is little or no interference from other stations and electrical apparatus, and the general cost to the subscriber is low.

The great disadvantage of wired broadcasting is, of course, that the listener has no say in the selection of programmes and must take what the organization chooses to give him. The man with the regular radio set, on the other hand, has a much greater choice of local programmes and if equipped with a high frequency band can roam the ether to pick up broadcasts directly from other countries. If broadcasters do not adopt the necessary innovations to assure that radio remains an effective means for the exchange of ideas, wired broadcasting may become a serious competitor.

At this point a word is due about radio's new challenger, television. Obviously if television is destined to replace broadcasting in the near future there is less need to spend the time and effort necessary to give the broadcasting a new lease on life. Although the experience available to date is fragmentary, it is definitely reassuring to radio. In the first place it has been found that in the few countries where television coverage now is close to equalling that of radio the purchase of radio sets has

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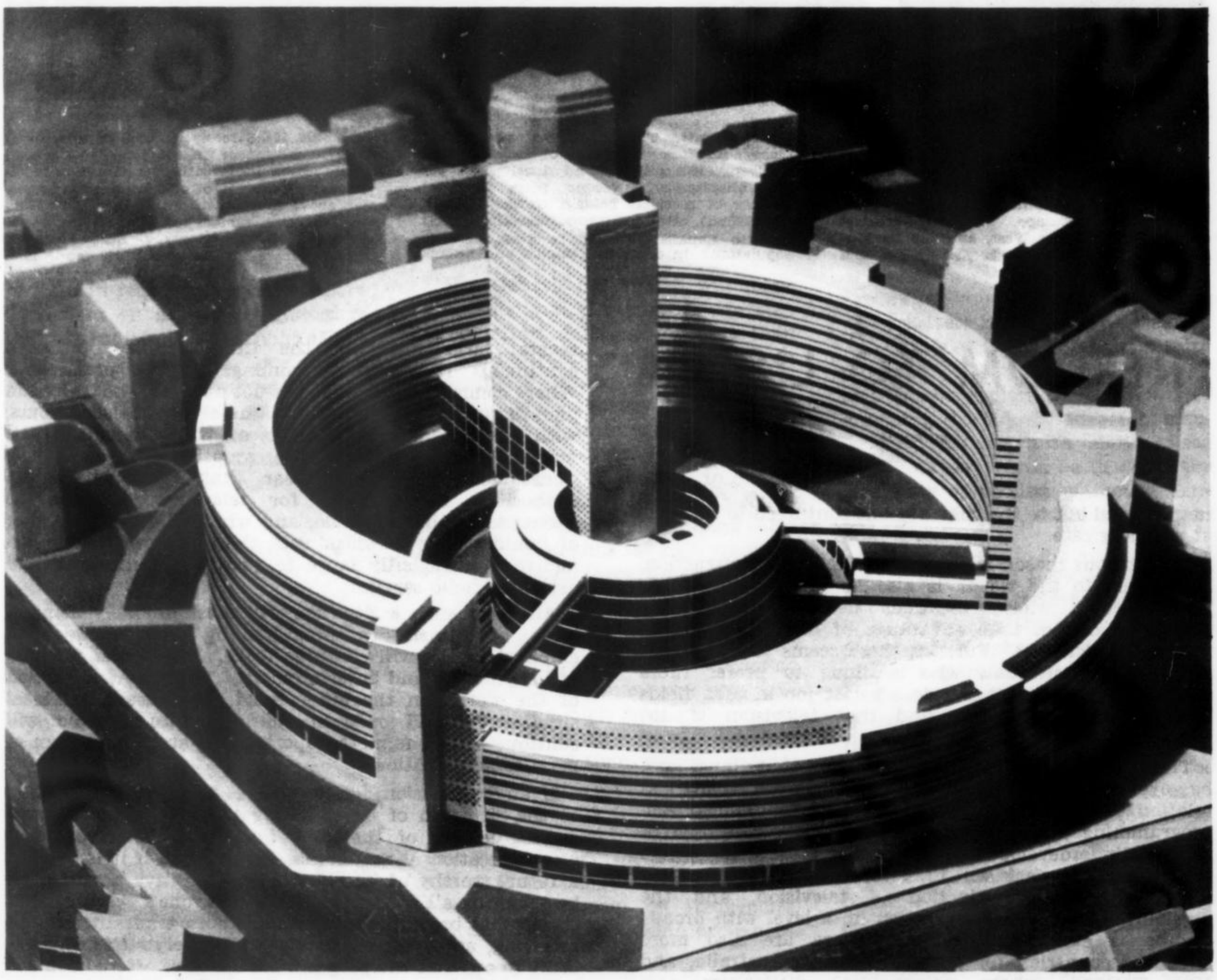
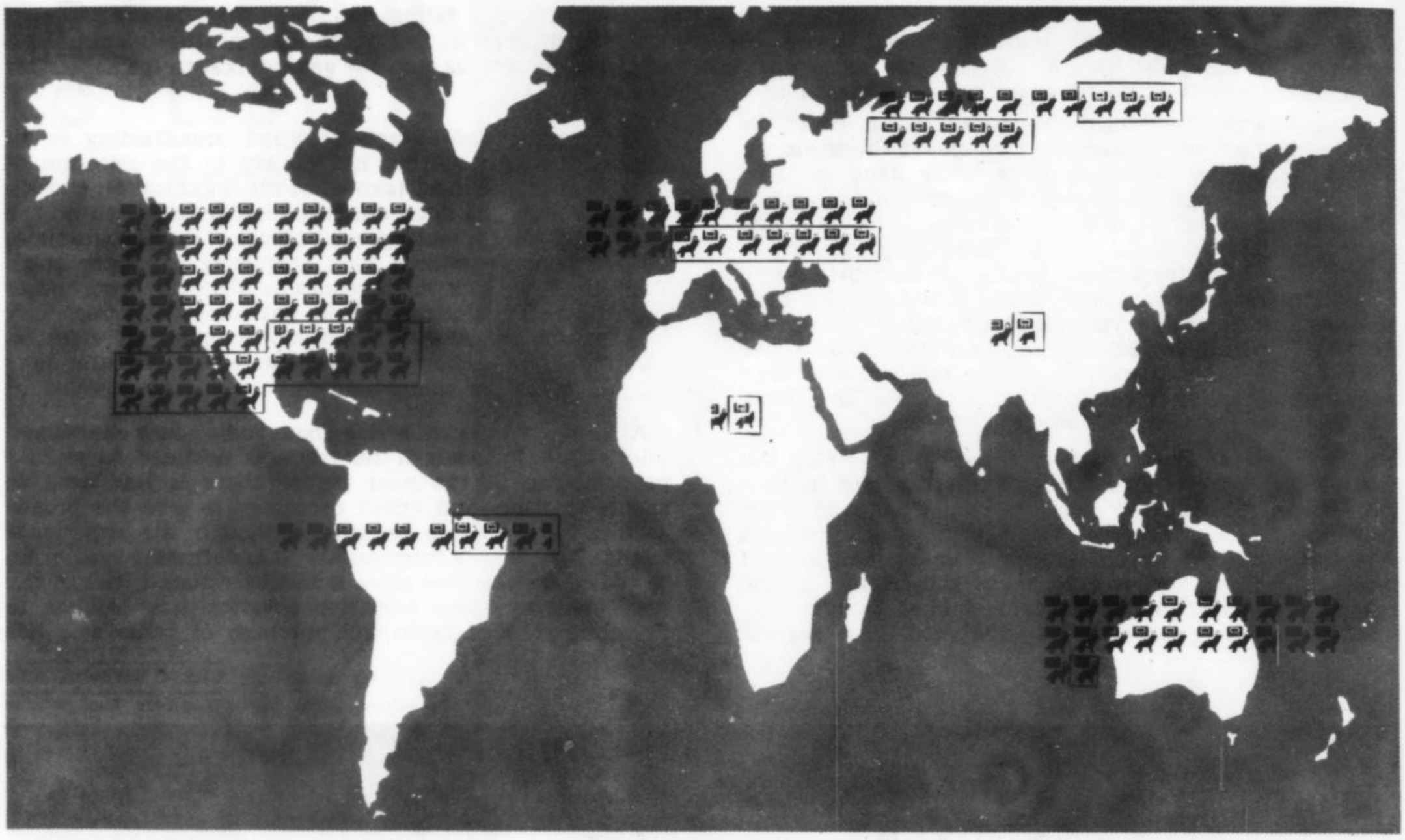


RADIO CITY IN PARIS. A huge circular structure nearly 500 feet in diameter which is now rising on the right bank of the Seine in West Paris will be the new headquarters of French radio. When completed it will have 15 special studios for musical, theatrical and variety performances, five large halls for shows with live audiences (one hall will seat 900 people) ; a vast collection of books, scores, recordings and other background and documentary material ; a central recording section ; two special halls for televised variety programmes ; a special section for the production of cultural and artistic programmes intended for listeners outside France.



Pictograph from Unesco's "Broadcasting Without Barriers," 1959

The world total of receiving-sets is estimated at over 350 million. These sets are unevenly distributed, however. One half of them are located on the North American continent alone. Another third are distributed throughout Europe, with the greatest concentration in the West, and the remaining sixth are scattered over Asia, Africa and the Near East. The United States is in first place both from the point of view of total receivers (160 million) and density (88 per 100 inhabitants). Second place in total number of receivers belongs to the U.S.S.R. (33 million), although second place in density goes to Canada with 56 receivers per 100 population. In contrast Ethiopia and Eritrea have only 16,000 receivers for a population of some 20 million or an average of 0.1 per 100 people. Even India with over a million receivers has an average of only 0.3 per 100 people. Map above shows distribution of world's radio receivers, each symbol representing one receiver per 100 inhabitants. Boxed symbols indicate increases between 1949 and 1956.

FREEDOM TO LISTEN

(Continued)

not declined but to the contrary has continued to increase at a steady rate.

The obvious reason is that television's extra attraction, the appeal to the visual, is also its greatest drawback. Those people whose vocations demand visual concentration cannot take advantage of television as they can of broadcasting. Further, there seems to be a great number of individuals who continue to prefer radio because they believe it can do a better job in such fields as news and music, or find that television is not compatible with leisure pursuits such as reading.

There is also an economic factor that must not be overlooked. Television is extremely expensive in relation to broadcasting, as concerns both upkeep and programming. In addition it is a voracious consumer of talent. Underdeveloped countries and those areas where the economy is weak will have to wait a very long time indeed for the introduction of television, and the possibility of achieving saturation on a level with broadcasting is exceedingly remote. There are also more advanced countries, for example Norway, Australia, and New Zealand, where geographical difficulties and scattered populations will delay television expansion and where the final achievement of television coverage will be measured not in years, but in decades.

Even where adequate coverage is achieved, it seems unlikely that 24-hour programming, as is the case in several large cities in the United States, or even continuous 12-hour programming, will be practicable. Where commercial television is not adopted, the European plan of restricting television to the evening leisure hours, with perhaps a few minutes of "telecasting" in the morning or at noon, will probably be continued. Consequently, it seems clear that even where the authorities can provide for television coverage as extensive as that of radio, and where the same number of families have television sets, there still will remain an audience sufficiently large to justify a continuing and extensive radio service.

Although such a situation will most probably demand some adjustment in programming and changes in emphasis, radio will continue to be an essential medium of information and entertainment. In the larger portion of the world, on the other hand, where such an ideal situation is still only in the dim future, radio will continue to be the most important all-around medium of mass communication.

If any conclusion can be drawn from an examination of the situation of broadcasting today it is that broadcasting is one of the most important means of mass communication at mankind's disposal and if it is to have a future worthy of its potentialities positive action must be taken by all concerned. It is everyone's responsibility to see that broadcasting facilities, both transmitting and receiving, are available to all. It is everyone's responsibility to see that the programmes that are offered contain all that is necessary to provide the listener with means of enriching his life. It does not follow, of course, that the listener will always take advantage of the best in broadcasting, but if he does not have access to radio, and to a choice of good programmes, he is being denied the basic right to listen.

TRAFFIC JAM ON THE BROADCASTING BANDS

by Julian Behrstock

THE African villager who joins his neighbours to hear local broadcasts on the community set and the uptown New Yorker who twirls the dial of his high-powered short-wave receiver in a skyscraper apartment alike have a stake in a world radio conference which opened in Geneva, Switzerland, in August.

This conference, sponsored by the International Telecommunication Union (ITU), will gather together government officials and radio broadcasters from 100 countries. During four months in Geneva, they will seek to hammer out agreement on pressing problems affecting the role of radio in the world today.

The problems concern both transmission and reception of broadcasts. Competition between countries in expanding their overseas broadcasting services in recent years has hindered agreement on an orderly system for the international allocation of frequencies. Meanwhile, new stations are being built, more powerful transmitters are coming into operation and rival transmissions increase. Pirating of frequencies and jamming add to the difficulties of the listener.

Wanted ! 400 million sets

A problem of a different kind is experienced by nearly 60 per cent of the world's people, most of them in Asia and Africa, who lack efficient, low-cost receivers to pick up even local broadcasts. Community sets, inconvenient for many listeners and often costly because of high taxes, are the only means of reception in many areas. Nearly 400 million receivers would have to be mass-produced to assure an individual set for each family in the under-developed countries (For one example see "Saucepan Radio", page 26).

These will be among the questions preoccupying delegates to the ITU's Administrative Radio Conference, the first such conference to be convened in eight years. They are also a major concern of UNESCO, dedicated as it is to promoting the use of broadcasting, and all the other means of mass communication, for the free flow of information and ideas.

UNESCO has sent its Member States a series of four proposals for possible submission to the Radio Conference. The principal proposal urges that agreement be reached on a sound plan for distribution of high frequencies—the frequencies used for long-distance broadcasting. It suggests that procedures should be established by which the ITU could assist radio services in making more effective use of frequencies. Consultation with each other through the ITU would enable them, for example, to minimize the occurrence of broadcasts at the same time and on the same frequencies, which results in little more than noise for the listener.

The Geneva conference will mark a further and perhaps decisive step in an effort dating back more than 30 years to reach world agreement on frequencies. Since 1928, when a first international frequency list was drawn up, a series of conferences has sought to put a plan into effect. It became progressively more difficult to cut up the pie as governments made mounting requests based on expanding radio services. Demands for high frequencies have been three times in excess of available resources.

Today the great majority of States maintain international broadcasting services beaming numerous programmes daily on high frequencies to all parts of the world. Despite the vast expenditure of time, money and effort, the audience remains small and in some areas is numbered only in thousands or even hundreds of listeners. Broadcasters themselves will be the first to acknowledge the crying need for agreement on frequencies, schedules and programme exchanges.

UNESCO has drawn these points to the attention of its Member States in urging remedial action at the Geneva Conference. Such action, says UNESCO, would help broadcasting achieve "its great potentialities as a vehicle for the exchange of information and ideas throughout the world".

A second UNESCO proposal deals with the interference hindering even local reception of broadcasts in some areas as a result of overcrowding of the low and medium frequency bands. The experience of a number of countries, particularly in Europe and North America, has shown that frequency modulation (FM) broadcasting in the very high frequency band may be expanded for use in local broadcasting, relieving much of the burden in other bands. It provides the listener, moreover, with a high quality signal relatively free from interference. UNESCO recommends that FM be introduced more widely.

Remove crushing taxes

THE widespread need for radio receivers in the under-developed countries is the object of a third proposal. It suggests that the ITU and UNESCO explore the possibility of designing a robust, wideband, inexpensive receiver, with standardized parts. A study would be made of the feasibility of pooling markets to encourage mass production of receivers of this kind.

Even in some of the more advanced countries, radio receivers are still a luxury, due to their high original price, cost of upkeep and the imposition of import duties and sales taxes. A UNESCO survey shows that some 85 countries levy import duties on radio receivers; these charges often represent 50 per cent or more of the value. Reduction of duties and sales taxes is accordingly suggested in UNESCO's fourth proposal.

Indications are that all four proposals suggested by UNESCO will be sponsored by governments and submitted to the Administrative Radio Conference. Their adoption would help to improve conditions for both transmission and reception of radio broadcasts, making this a better medium to entertain, enlighten and link people all over the world.

RADIO 'HAMS': AN INTERNATIONAL FAMILY

by

David

Gunston

In almost every corner of the globe, in living rooms, dens, attics and special "shacks", 260,000 radio "hams" maintain a vast network of personal contact by voice or Morse Code. Most amateurs use self-built apparatus costing from £25 to £50. Right, a very elaborate set-up operated by a U.S. amateur in California.

J. B. Knight Jnr., U.S.A.

USIS

ALL AGES AND PROFESSIONS are numbered among the more than one quarter of a million amateur radio operators scattered over the globe. Above, Leonard Ross of Tujunga, California, who was believed to be the youngest ham operator in the world when in 1953 he passed the General Licence class test at the age of eight. To pass the test he had to demonstrate his ability to send and to receive at least 13 words of Morse code a minute. Photo shows Leonard, aged eight, operating the equipment in his radio shack.

No study of communications in the modern world would be complete without an account of the unique contribution of amateur short-wave radio enthusiasts, or "hams," who form a great army of private individual communicators. In almost every corner of the globe, in living-rooms, dens, offices, cabins, attics, cubby-holes and outbuildings (all universally referred to as "shacks") some 260,000 licensed operators maintain a vast network of personal contact by voice or Morse Code signals that is entirely free from political or propaganda influence.

Daily, hourly in fact, "hams" are in touch with fellow-enthusiasts of both sexes and all ages in countries near and far. It is an achievement without parallel, impossible to envisage even fifty years ago, and the contribution towards fuller international understanding and goodwill cannot be measured.

Official Soviet photo

SOVIET 'HAMS' in 1958 received and sent 854,000 cards, known as QSL-cards, which are the amateurs' method of confirming the establishment of two-way radio contact. Here two novice "hams" at the Pedagogical Institute in Karaganda, Soviet Kazakhstan, are seen assembling one of ten ultra-short wave transmitters which they are building as a gift for rural schools. They are members of a special radio club where they study the international "ham language", operate their radio station and join in contests and shows of self-built radio equipment.

Amateur radio—and every "ham" will stress the vital importance of his status—is primarily a hobby, but as such must be the only one duly defined by an international treaty drawn up by 90 nations. At the International Radio-Communications Conference held in Atlantic City, U.S.A., in 1947, it was defined as: "A service of self-training, intercommunication and technical investigations carried on by duly authorised persons interested in radio technique solely with a personal aim and without pecuniary interest."

Most amateurs, however, would probably define their compelling interest more simply as "the practice of two-way, short-wave radio-communication, not as a business or means of profit, but as a spare-time hobby pursued for the pleasure to be derived from an interest in radio technique and construction, and for the ensuing friendships with like-minded individuals throughout the world."

Strictly speaking, the description "amateur" in this connexion is not applied to any neophyte or dabbler with radio apparatus, but only to duly licensed transmitting operators whose stations, or "rigs", have the official sanction of their respective governments. Whatever the connotation in other spheres, in the field of amateur radio the prefix is a mark of distinction, superior knowledge and accomplishment, and very much a cachet to be achieved. In addition, there are large numbers of persons with no desire to become transmitters operating under official license, but who follow the hobby purely as listeners using short-wave receivers. They are known in "ham" parlance as SWLs (short-wave listeners).

The pursuit is just about as old as radio itself. It had its beginnings in the very earliest days of the invention. Around the turn of the century, when vague details of the newly-born art of wireless telegraphy, as it was then known, began to filter through to scientific journals and beyond, technically-inclined persons began to feel the first glimmerings of the very real fascination that now absorbs the attention of over a quarter-of-a-million people.

Marconi considered himself an amateur, and when he finally succeeded in spanning the Atlantic Ocean by radio in 1901, small groups of youthful experimenters in many countries resolved to find out for themselves how it was done. Initially, their work was crude and limited: they were at first fortunate in sending and receiving wireless waves over distances of a few feet. Gradually the range increased to yards and eventually to many miles as new detectors, new circuits and new aerial antennae were constantly tried out.

Transmitting to the moon

AMATEUR radio began long before there were short-wave bands fitted as a matter of course to ordinary radio sets, indeed long before radio receivers were widely known at all. Oddly enough, the first "hams" were eventually to prove that messages could be sent and received all over the world on low power by using the very short waves which the experts said were useless, and the period 1921-1926 witnessed epoch-making discoveries in the field.

Amateurs in many scattered countries demonstrated that high-powered transmitters such as are used for normal daily long-and medium-wave transmissions or programme broadcasts were unnecessary when wave-lengths below 100 metres were adapted for world-wide communication. This brought the hobby within the scope and purse of ordinary folk everywhere, and although large sums can easily be spent on short-wave radio equipment, most of today's amateurs operate on apparatus they have built themselves costing less than £50, whilst there are many small but complete and reasonably efficient stations constructed by their owners for half of this figure or even less.

Naturally, keen operators may spend more than these figures renovating or extending their equipment, and the annual turnover in apparatus, though not essential, may be large. Surveys show that whereas about 80% of amateur transmitters are home-made and the rest are bought ready-made, the reverse is the case with receivers. This is because the modern superheterodyne radio receiver is such a complex and precise instrument that elaborate factory equipment is needed to construct it. So receiving sets are usually cheaper and better-made than those built at home, whereas transmitters are costly when made

CONTINUED ON NEXT PAGE

RADIO 'HAMS'

(Continued)

commercially, and are best modified to local needs when built by the operator himself.

However, apart from practical and financial considerations, many "hams" have no wish to deprive themselves of the sheer creative delight of seeing the fruits of their own hands perform the continuing miracle of transporting their voice or code signals across enormous distances and bringing back the immediate reply of a kindred spirit perhaps on the other side of the globe.

Nowadays the range of well-equipped amateurs is limited only by the dimensions of the earth, and in fact not always by that. Several "hams" have managed to transmit signals to the moon and record their reflection, whilst many operators have tracked the various earth satellites, and continue to work as monitoring stations for this purpose. Naturally, conditions vary with the seasons, the weather, the time of day and sunspot influence, but to talk with friends many thousands of miles away is a daily occurrence for all "hams". The most important factor in securing good results is the choice of the most suitable frequency band for transmissions, for each wavelength has its own peculiar properties.

Although nowadays many official broadcasting stations as well as ships and aircraft use the short-waves, almost every country—by international agreement—allots amateurs certain fixed bands, outside the limits of which they must not operate. However, every amateur is allowed at any time to choose the band he wishes to use and he is also allowed (subject to certain band-planning schemes designed for the general good) to select his own frequency and to change it when he desires.

'DX hounds' & 'ragchewers'

This is an important point on the more crowded short-wave-bands since it allows the keen amateur to search for and then use a clear frequency (or "channel"), then should heavy interference be experienced later, to move immediately to another position on the same band. With code signalling, it enables what is known as "singlechannel operation" (with both stations on approximately the same frequency) to be used. Every short wave-band has its limitations and problems, but while they are never too great to allow free operation, the amateur has always some new field to conquer.

Most "hams" have equipment that will operate by voice or by Morse Code, with roughly half the messages being transmitted by each method. Code work requires less complex apparatus and may include the use of specialized codes like the International Q Code which reduce the language barrier. All licensed amateurs have to prove their proficiency in Morse Code before they are allowed to operate. Indeed, no one in any country can expect to secure his amateur license without preliminary study, application and practice, though self-training is not difficult.

Most countries insist on written as well as practical tests, and there is usually an age-limit of 16 or 18, though several countries have reduced this to 14 or even 12. The United States, Japan, Ireland and Israel are noteworthy exceptions to this rule, fixing no age limit. Again, most but not all countries insist on their operators possessing citizenship: Germany, Finland, Morocco and Chile being among the exceptions here.

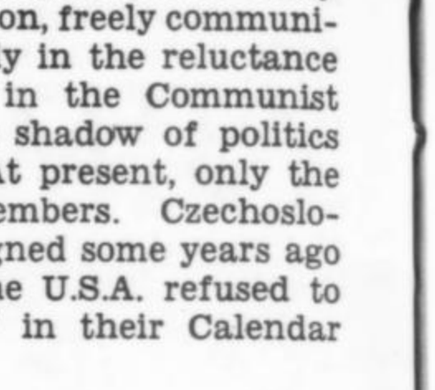
How many "hams" are there in action today? The American Radio Relay League, largest member-body of the International Amateur Radio Union, currently estimates that there are rising 260,000 of them, of which 190,000 are in the United States and its possessions. There are at least a few amateurs in every country, and the countries of Eastern Europe and the U.S.S.R. are no exceptions.

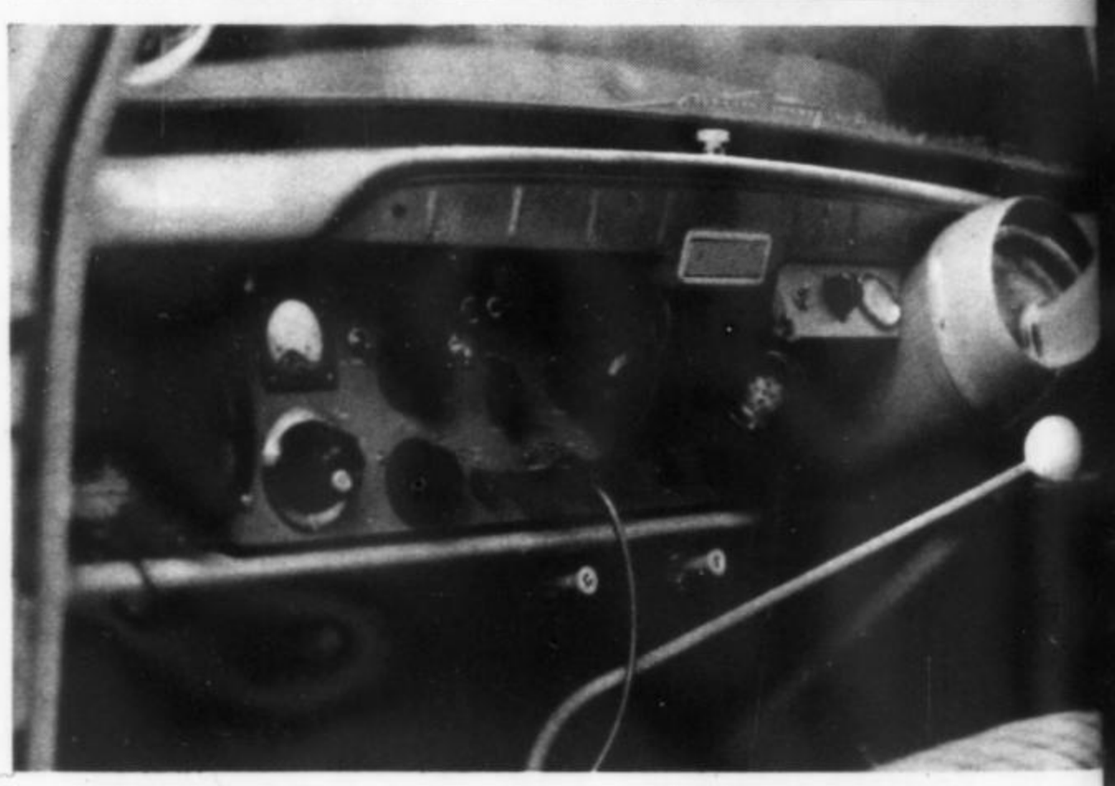
Amateur radio ignores the existence of frontiers and though the fact is not generally realized, there are today perhaps 10,000 "hams" in the Soviet Union, freely communicating with the rest of the world. Only in the reluctance of national amateur radio societies in the Communist countries to join the IARU does the shadow of politics fall across the encouraging picture. At present, only the Polish and Yugoslav societies are members. Czechoslovakia was formely a member, but resigned some years ago because the IARU headquarters in the U.S.A. refused to print the Stockholm "Peace Appeal" in their Calendar Bulletin.

At present, some 54 countries have their own member-societies affiliated to the International Amateur Radio Union, with three others under consideration. India is a particularly welcome new admission, with about 200 operators, while other representative countries (with approximate number of amateurs) are: France, 2,800; Brazil, 9,000; Poland, 250; South Africa, 2,000; Cuba, 900; Mexico, 900; Venezuela, 320; Canada, 8,000; Japan, 5,200;

HAM ON WHEELS. More and more amateur radio enthusiasts are turning their automobiles into mobile radio stations by installing equipment like that shown below. Right, Canadian radio "ham" operates a short-wave mobile unit. In Britain too, aerials like the one on the rear of this car are becoming a familiar sight. Amateur station number is carried on bumper bar.

Photos T. Holloway, England





Great Britain, 8,500; Yugoslavia, 300; Spain, 830 and Germany, 5,000. In addition to these, there are organized groups of amateurs in such widely-separated places as Hong Kong, the Philippines, Austria, Costa Rica, Iceland, Peru, Syria, Uruguay, Malaya, Colombia, Burma, Ecuador, Finland, Australia and the Belgian Congo.

To the outsider, the amateur radio movement would seem to be a particularly well-organized one, with flourishing if small national societies (all distinguished, in true amateur radio fashion, by their initials—PZK (Poland), EDR (Denmark), USKA (Switzerland), etc.—in almost all countries. Banded together into the well-organized IARU they seek continual improvement in "hams" relations with their governments, arrange international agreements affecting radio communications and in the words of the IARU's Constitution, "the encouragement of international fraternalism". International Conferences have in fact

been successfully held in Madrid (1932), Cairo (1939), Atlantic City (1947) and the next World Radio (International Telecommunications Union) Conference is due to be held at Geneva in the summer and autumn of this year.

But what, on the personal level, of the "hams" themselves? What do they talk about, and how do they contribute towards international understanding? Most licence regulations expressly forbid the dissemination of any messages of political, religious or commercial content, leaving the amateur free to talk on personal and technical matters to his heart's content. In actual fact, innumerable individual topics are daily discussed over the ether, with radio equipment and performance easily the most popular!

Despite its high degree of specialization, amateur radio consists of many phases of activity. An experimenter will chat about his "rig" and compare endless notes with others. A "DX hound" (DX meaning long-distance) is a kind of angler of the ether, always hoping to pick up some rare or remote station in another part of the world.

A "ragchewer", or born gossip, is content to talk for hours on end about his country and home, the weather, his friends, his fellow-amateurs and the like. A "traffic-handler" will spend much of his time at his station in the clear service of others, relaying messages free of charge for the general public, simulating a regular communications system with national trunk lines and feeder networks for possible emergency need, though all amateurs rise to the occasion when difficulties or disasters occur.

Wherever there is a large-scale natural or man-made disaster, with the frequent disabling of telephone and commercial radio systems, amateurs step into the breach to provide substitute communication links to the affected areas. For example, an earthquake may cut off local rescue teams from the outside world, to which they can be speedily linked by radio "hams", or in cases of fire or explosion nearby amateurs can direct calls for help swiftly to the right quarters when other means of communication are out of action. This actually happened in the Texas City disaster of 1947 when, had it not been for radio amateurs, communication links would have been non-existent and rescue work gravely delayed. In the disastrous floods in Eastern England in January and February 1953, "hams" set up an emergency network which operated continuously in conjunction with the police and ambulance services.

Many "hams" in Europe, South Africa and America have assisted expeditions and similar ventures by providing constant radio links. The famous Kon-Tiki expedition of Thor Heyerdalil was in regular contact with amateurs in many countries as it drifted across the Pacific, while more recent Arctic and Antarctic teams have benefited not only by radio links provided by amateurs, but by the regular relaying to their distant outposts of personal messages from the homes of the men themselves.

Many others make a special point of relaying such messages at fixed times to servicemen of their country stationed in remote places, even the North Pole. Eighteen-year-old Julius Madey, of New Jersey, U.S.A., winner of the 1958 General Electric Edison Radio Amateur Award, was cited for relaying more than 12,000 messages for American servicemen at isolated Antarctic, Arctic and South Pacific posts, and once through his station a young mother announced the birth of her baby directly from her hospital bed to her husband in Antarctica. Another American amateur who was also specially commended recently for his public services was 54-year-old Kenneth M. Blaney of Sacramento, California, who spends twelve hours a day handling messages and recording important data on the Explorer satellites.

Amateurs win a race for life

WHEN the inspired French film "Race for Life" (*Si tous les gars du monde...*), which received the British Film Academy United Nations Award for 1957, was released, its story of help provided in a case of sickness at sea by a chain of "hams" all over the world, bringing an injection serum to the North Atlantic by means of messages relayed via Togoland, Paris, Munich, East Berlin and Norway, was viewed by many critics with scepticism.

It provided, in fact, a typical instance of just how amateurs can and do provide help in emergencies, and was based on actual occurrences. Furthermore, whilst making the film, director Christian Jaque was personally involved in a like case, wherein a French "ham" picked up an urgent call sent out by two amateurs in Brazil. They were sending out a call for information on the correct dosage of a new antidote not then in general use they had received from Peru. Within the hour, the details from Paris were in the hands of the Peruvian doctor.

Many other amateurs assist their governments in service and civil defence work, notably the Military Amateur Radio System in the U.S.A. (MARS), which provides a nationwide communications network consisting entirely of amateurs upon which the services can rely in an emergency. Some "hams" aid coastguards, police and weather forecasters, report on traffic problems, speed the rescue of men from wrecked ships and aircraft, even assist in the training of young people and the blind in electronics.

In addition to these practical services, amateurs constantly further the development of the art and science of radio by their experiments and observations. Being usually unencumbered with ponderous knowledge, they sometimes get to the heart of a technical problem quicker than the professionals, while advances in many fields of electronics, radar and long-distance radiotelegraphy have originated in "shacks" all over the world.

From the schoolboy in Chile and the mining engineer in Australia to the missionary in Samoa and the student in Lithuania, the growing army of "hams" is a truly dedicated group with a spirit of human service hard to equal.

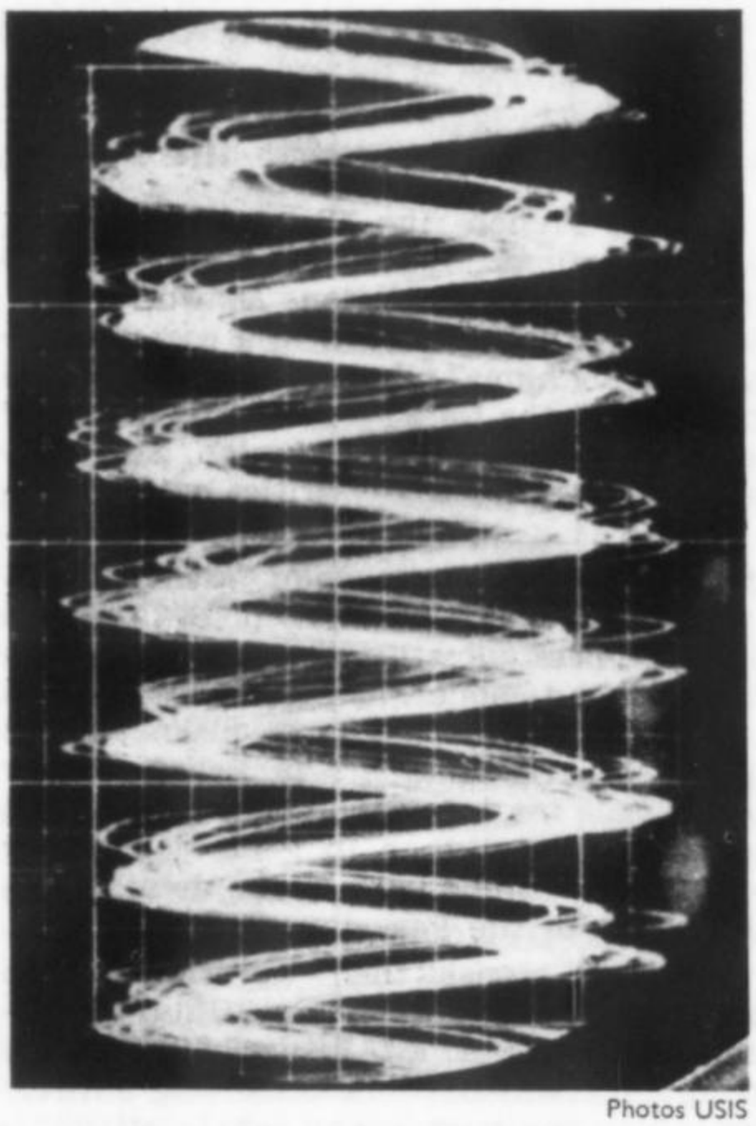
INTO OUTER SPACE ON RADIO WAVES

by Werner Buedeler
Fellow of the Royal Astronomical Society

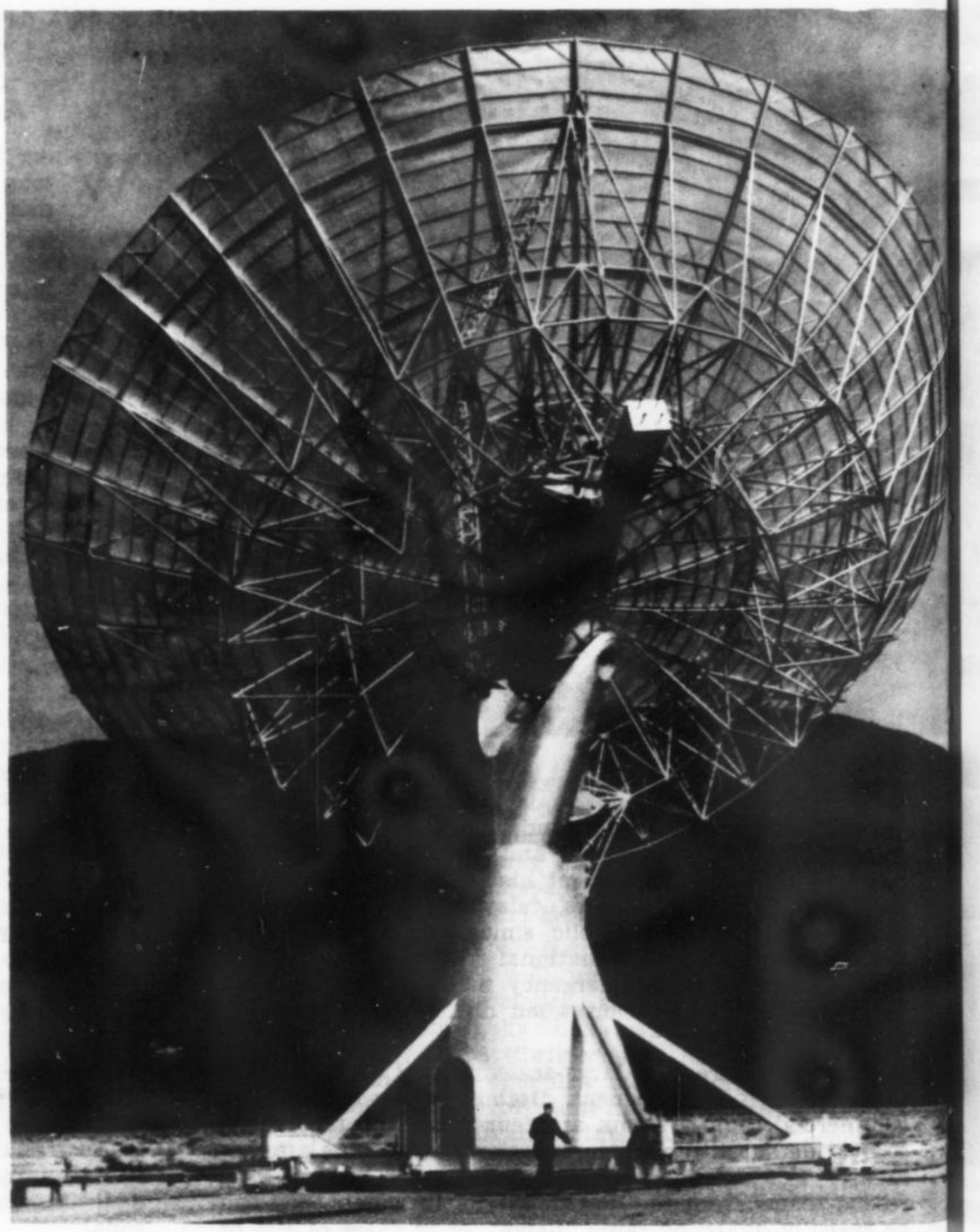
ONLY for the past thirty years have astronomers known that radio waves, one of man's most useful servants on earth, are being created within stars and in inter-stellar space as well. Since the end of the Second World War, however, these "messages" from outer space have been recorded and scientifically evaluated. In this way, a new science—radio-astronomy—has come into being.

In the same way that the ordinary astronomer observes the stars through his telescope, the radio astronomer listens to strange sounds giving him information about electronic processes in the solar corona (that is, the outer region of the sun), invisible phenomena in the centre of our own galaxy, and the expansion of the universe. Special receiving antennae, occasionally of tremendous, size, have been constructed in order to pick up the faintest noise from cosmic space.

Radio astronomers have obtained such a wealth of new information in recent years that radio telescopes have now become almost standard equipment in many observatories. Radio-astronomy has enabled scientists to discover colliding galaxies in space and the remains of supernovae which exploded thousands of years ago. By carefully recording cosmic noise (the name now given to radio signals from outer space) they can trace interstellar clouds of hydrogen, masses of this lightest of all elements which are distributed among the stars. Recording the electromagnetic or radio waves "broadcast" by interstellar hydrogen on a precise wavelength (21.1 centimetres) has enabled astronomers to prove that our own Milky Way has spiral arms like those which other galaxies in space were already known to possess. Today, radio-astronomy is one of science's most flourishing and exciting fields.



Photos USIS



EAR ON THE UNIVERSE. Giant antenna (right) is one of two 90-feet diameter saucer-shaped "ears" which work as a team at a California observatory, picking up waves from radio-active stars up to 30,000 million light years away. Some day they may be used to track and guide space ships as they speed far out into the universe. Above, radio signals from the "Explorer" satellite launched in January last year. This is how the first few seconds of its flight were recorded on the graph of an oscilloscope at one of a network of 10 powerful Minitrack radio stations in Australia, Cuba and the U.S.A. set up to receive the satellite's radio messages which it relayed during its globe-circling trips.

First, astronomers discovered radio communication in space (it does not consist of "messages" sent by living beings on other planets but of crackling sounds and noises relayed back and forth between atoms). Then they tried to send man-made radio waves into space. Shortly after the Second World War, they succeeded in establishing radio contact with our nearest cosmic neighbour, the moon. With the help of a powerful transmitter, a radar signal was flashed toward the moon and received almost three seconds later when it returned to earth after bouncing off the moon's surface. This confirmed earlier calculations of the distance of the moon from the earth (it averages 238,600 miles). As we know that the speed of all electromagnetic waves whether light waves, radio waves or X-rays is always 186,000 miles per second, it was an easy task to calculate this distance on the basis of the time which elapsed between the broadcasting of the radar signal and its return to earth.

Making radar contacts with the moon is almost routine today and, like radio astronomy, it tells us more about this body in space which man himself might reach in the near future. In the same way, astronomers have tried to "contact" the sun, Mars and Venus.

Radio waves in outer space came into their true glory, however, with rocket exploration of the upper atmosphere and the launching of artificial earth satellites. Here, man was able to send a transmitter into space for the first time and to receive its messages. The Sputniks, and the Explorer, Vanguard, Discoverer and Score satellites all had their own special transmitters telemetering back to earth information on physical phenomena in space — such as temperature and intensity of cosmic rays and ultraviolet solar radiation (which does not penetrate to the ground). A wealth of new information was gained.

Then, with the launching of the Score satellite roaring into space aboard a 70-foot Atlas rocket weighing 115 tons, a human voice recorded on a tape (the voice of the President of the United States) was transmitted back to earth from the world beyond. Simple as it may look to the layman, this experiment answered many questions for scientists and spurred thinking in terms of true communication satellites.

A few years ago, an American telephone company had already calculated that within the near future, communication satellites used as relays for transatlantic telephone calls and world-wide television service would be feasible, even from a business viewpoint. Three such satellites circling the earth in a 24-hour orbit (this means that they would need 24 hours to go around the world and thus they would appear stationary from any given point on earth if they orbited in a west-east direction) could transmit a television programme to any part of the world. Very-high-frequency radio, now limited by the short range of VHF waves requiring costly relay stations every 30 miles, would also benefit from such satellites.

The art of communication in space is still young and we have much to learn before man can flash messages from one side of the globe to the other via a space satellite or even a relay station on the surface of the moon But the many successes which have been achieved in so short a period of time prove that communication is no longer restricted to our own planet.

THE TALKATIVE SATELLITE

Running on solar batteries, the radio transmitter of "Vanguard I" is still functioning a year after it was launched and it has created a rather unusual problem for American scientists: they just don't know how to make it shut up. Dr. John Hagen, director of the Vanguard rocket programme, has commented that there is no way of stopping it and it is now interfering with the transmission of radio messages from other satellites. American scientists are now looking for a way of turning off the sun-powered radios aboard the Vanguards. Future satellites may be equipped with remote control off-on switches.

CALLING THE FLYING DOCTOR. In the vast open spaces of Australia radio is a vital link for people who live beyond the reach of the ordinary medical services. Thanks to radio links between isolated homesteads and the centres run by the Royal Flying Doctor Service, people in practically every area of the continent can ask for advice and obtain treatment. Above, farmer's wife takes down the doctor's instructions by radio. Pedal-operated generators are now generally replaced by batteries. Australia also has its "schools of the air" for children living far from town. The classroom of the two boys (below) is their living-room with receiver-transmitter. They live on an isolated sheep station and can talk to their teacher miles away as easily as if she were in the same room.

Photos Australian News and Information Bureau

PIONEERS OF RADIO

The story of radio is in no way the result of one man's genius. Rather it is the accumulation of a whole series of discoveries of scientists, engineers, physicists, chemists and philosophers of many nations, who in exploring the secrets of nature made electricity and electromagnetism accessible to mankind. On these pages we present only a few of the pioneers of radio.

HEINRICH HERTZ, German physicist and electrical engineer (1857-1894) discovered electromagnetic waves which are the basis of modern radio, television and radar. Studying cathode rays, Hertz proved that these would penetrate thin sheets of metal.

EDOUARD BRANLY, French physicist (1844-1940). His advance research led to the invention of the "Coherer" unit in 1890. The Coherer made wireless telegraphy, as it is known, possible.

NIKOLA TESLA (1857-1943), naturalized American of Yugoslav origin. Between 1890-93 he devised a system of wireless communication using high frequency alternators to produce long waves, to light lamps and send signals at a distance. He used metallic plaques to form condensers for reception. He invented a system of transmitting electric power without wires, the Tesla coil and condensers—vital to radio.

LEE DE FOREST (1873), American engineer who invented the vacuum tube in 1906—an invention considered as great as radio itself. By amplifying a weak current, it made it possible to magnify radio waves to audibility and to receive TV and radar images. It opened the way to the whole field of electronics.

RCA

W. H. BRATTAIN (1902) AND J. BARDEN (1908)

American physicists who won 1956 Nobel Prize for Physics for their invention of the transistor in 1948. Rapidly replacing the vacuum tube, the tiny amplifier uses differences in atomic structure to create an electron current using a hundred thousandth of the power needed by the tube.

Bell Telephone Laboratories

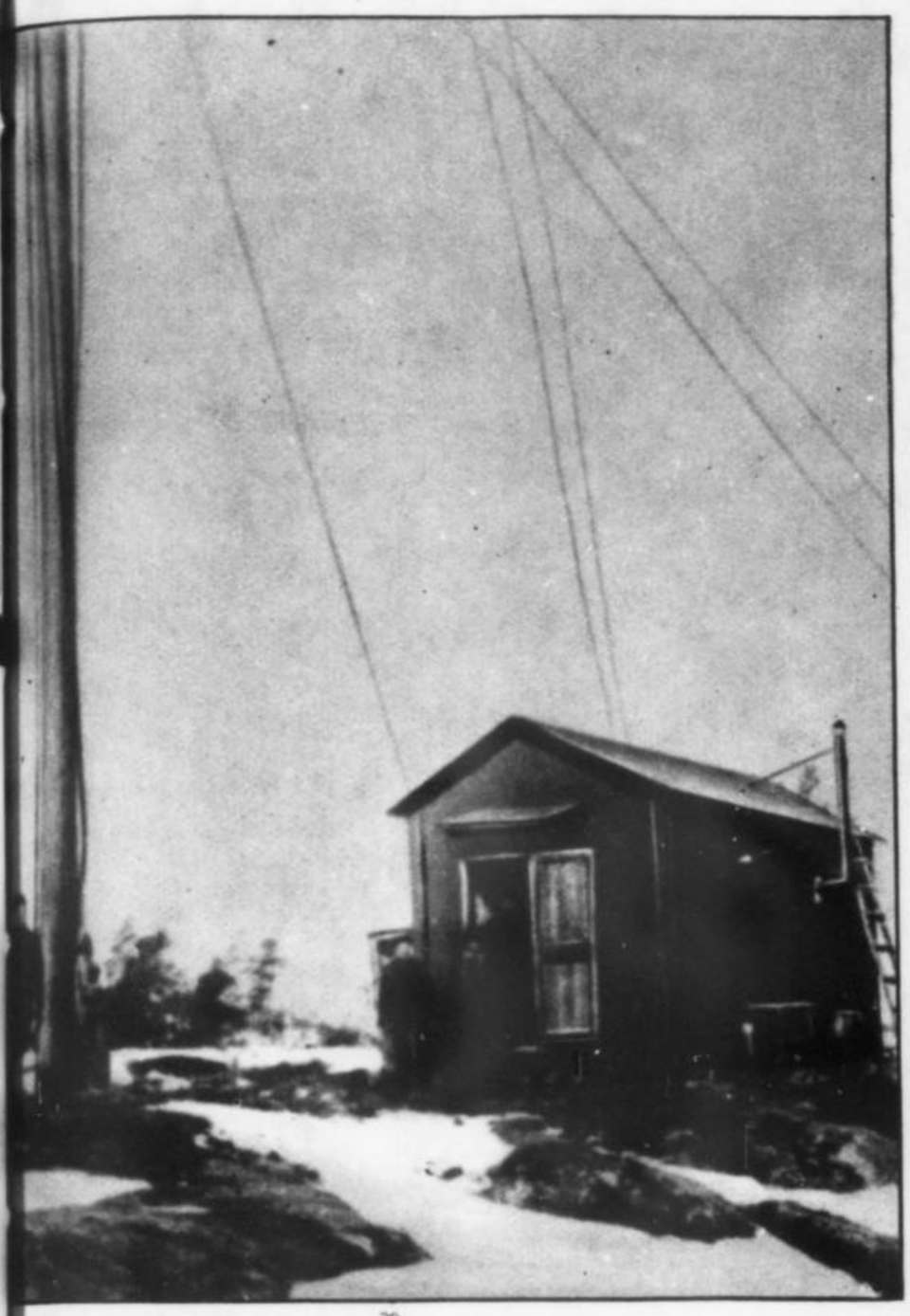
The stamps on these pages are reproduced from Radio Philatelia *by Herbert Rosen, a history of telecommunications told through stamps (publisher : Audiomaster Corp.,* 17 *East* 45*th Street, New York* 17. $2.00).

Aleksander Popov

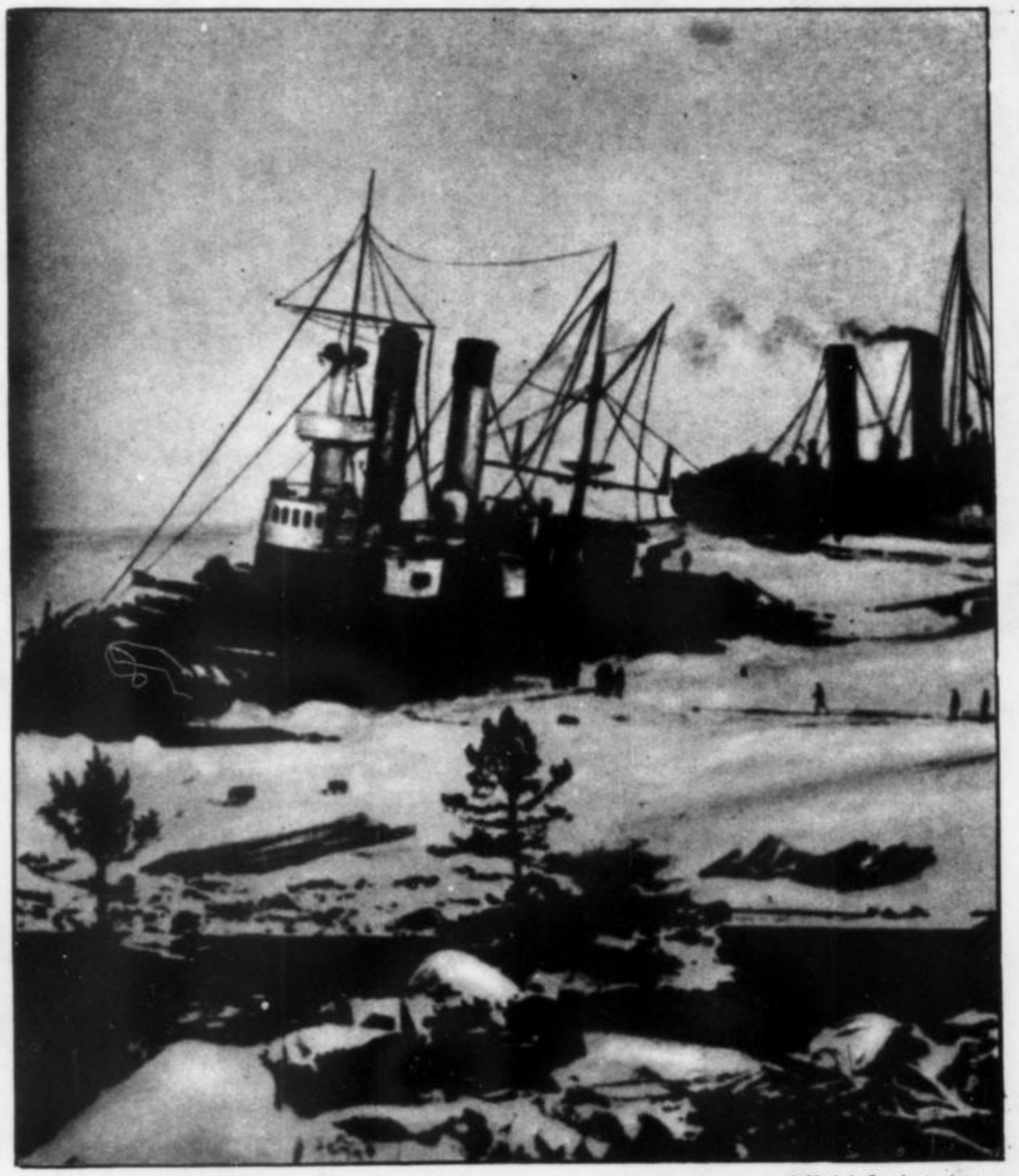
This year the Soviet Union celebrates the centenary of the birth of Aleksander Popov (1859-1905) whom it considers the inventor of the first radio receiver. In May 1895, Popov demonstrated before the St. Petersburg Physical Society an apparatus for receiving electrical air waves, then known as hertzian waves. Later the same year he created a "lightning recorder" to detect and register the discharges of electrical storms at some distance. Popov's experiments were inspired by the works of Faraday, Maxwell, Lodge, Hertz, Branly and Tesla. He predicted that if man could reproduce an electrical disturbance of the type emitted by electrical storms he might be able to communicate across space. Popov's first radio transmission took place in 1896. In November 1899, a Russian warship, the General-Admiral Apraksin ran aground near Gogland Island. To facilitate salvage operations, Popov and his assistant P. Rybkin were called upon to set up radio communication between the island and the stricken vessel. Early the next year, a wireless telegraph circuit was put into operation. Photos show, left, the radio station on Gogland Island; right, battleship Apraksin aground off the island, and behind it the ice-breaker Yormak.

Guglielmo Marconi

It was Guglielmo Marconi (1874-1937) who took out the first patent ever granted for a system of wireless telegraphy, in June 1896, and who was the first to use and develop radio communication on a commercial basis. Marconi's experiments had begun several years before in the vegetable garden of his father's farm in Italy, where as a boy of 20 he watched experiments by Prof. A. Righi with electromagnetic waves. After unsuccessfully attempting to interest the Italian Govt. in his work, Marconi reached England in 1896. His apparatus combined an improved Righi oscillator and Sir Oliver Lodge receiver circuit with a Morse Apparatus and a 30-metre antenna. In July 1896 he succeeded in sending and receiving a signal over a distance of 100 yards, later between two land stations, and from ship to shore and shore to ship, then between two ships at sea. In 1898, Marconi bridged the English Channel connecting England and France and in 1901 spanned the Atlantic between Newfoundland and England. Photos show kite-aerial he raised in Newfoundland (right), and radio operators with early Marconi installation on board a British lightship in 1898 (left). The wireless was used to bring help to the ship when it was damaged in a storm a month later and when it was rammed by a freighter in a fog, thus convincing shipping people of the value of radio.



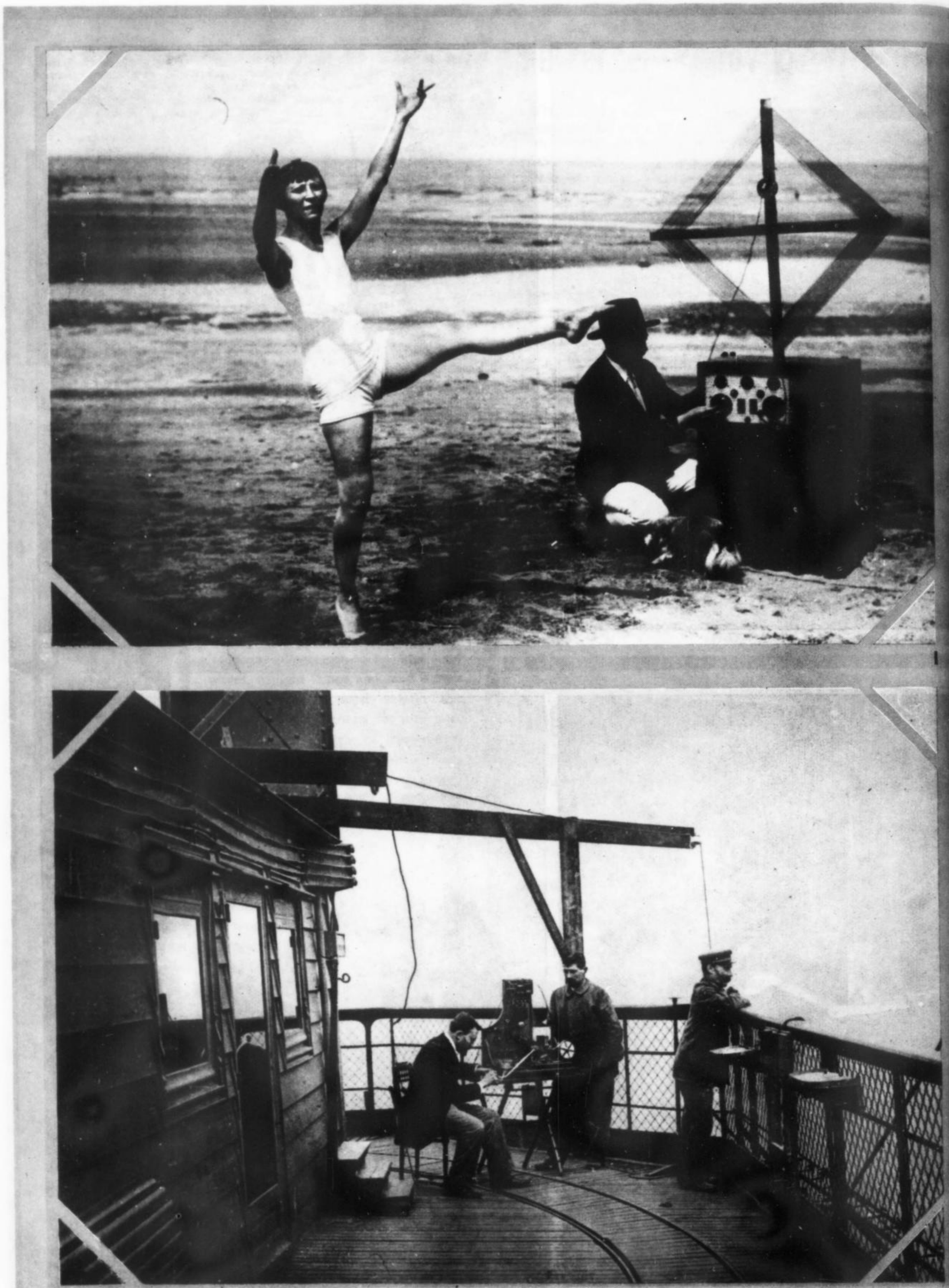
Official Soviet photos



Official Soviet photos

Marconi Wireless Telegraphy Co. Ltd

COI, London



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SNAPS FROM THE FAMILY ALBUM

1. In the 1920's, when broadcasting was taking its first hesitant steps, this photograph was "hot news". It shows Rosine, one of the celebrated Dolly Sisters, dancing on a French beach to the rhythm of music picked up from the ether.

© Viollet, Paris

2. A machine for sending wireless telegraphy messages was installed on the top platform of the Eiffel Tower on July 29, 1898, and experimental transmissions were made. In the same year, the Frenchmen Ducretet and Roger established communication across Paris from the Eiffel Tower summit to the Panthéon.

© Viollet, Paris

3. Dame Nellie Melba, the famous Australian soprano, sings into a microphone set up at Marconi's works on June 15, 1920. This was the occasion of first broadcast programme of public entertainment to be presented in Great Britain.

Marconi International Communication Co.Ltd.

4-5. Microphones were massive, box-like affairs when these photos of the cast in a radio play were taken in the studios of the British Broadcasting Corporation in 1928. The latest thing in feminine headgear at the time was the toque—worn well down over the ears.

BBC photos

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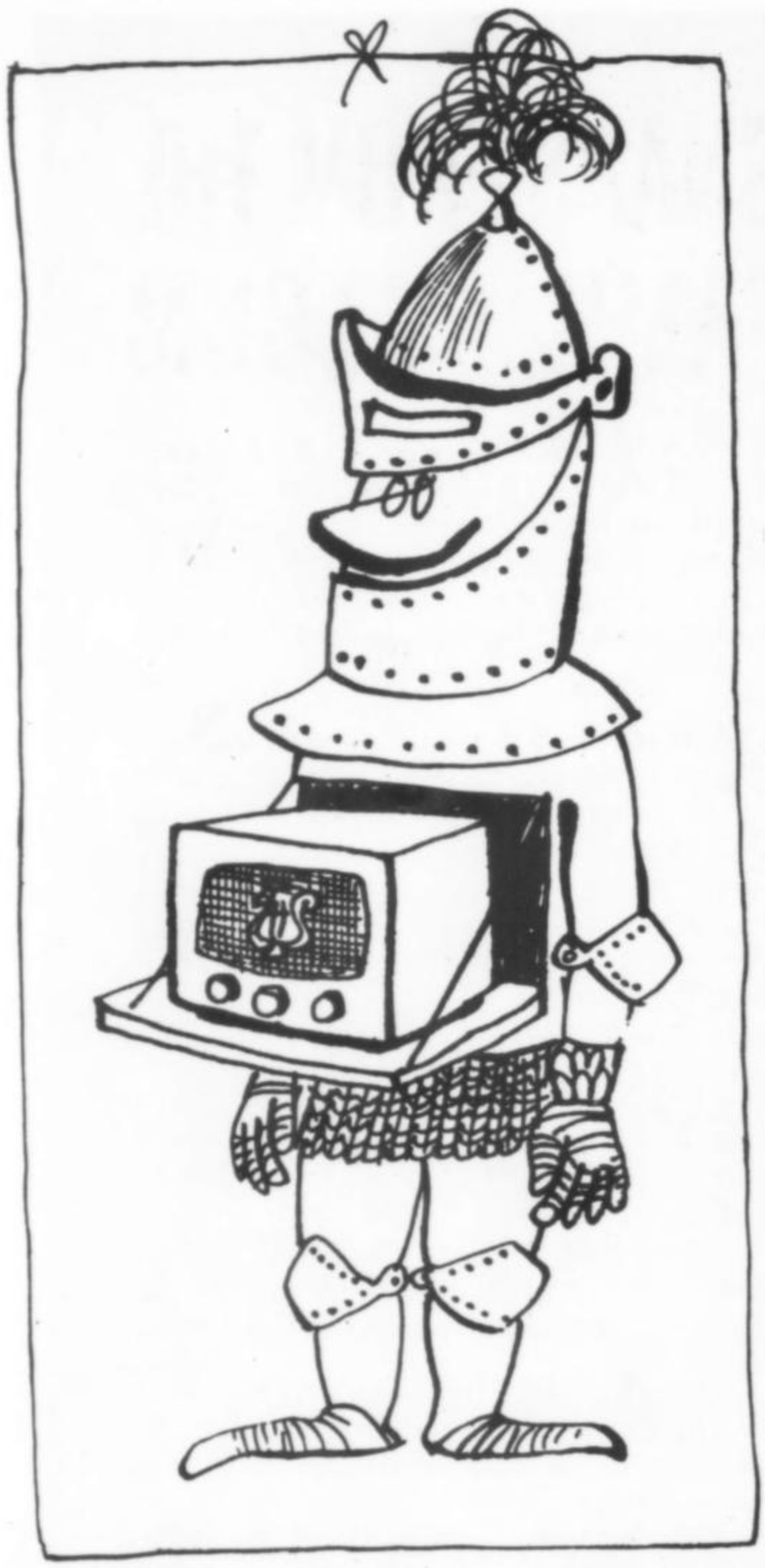


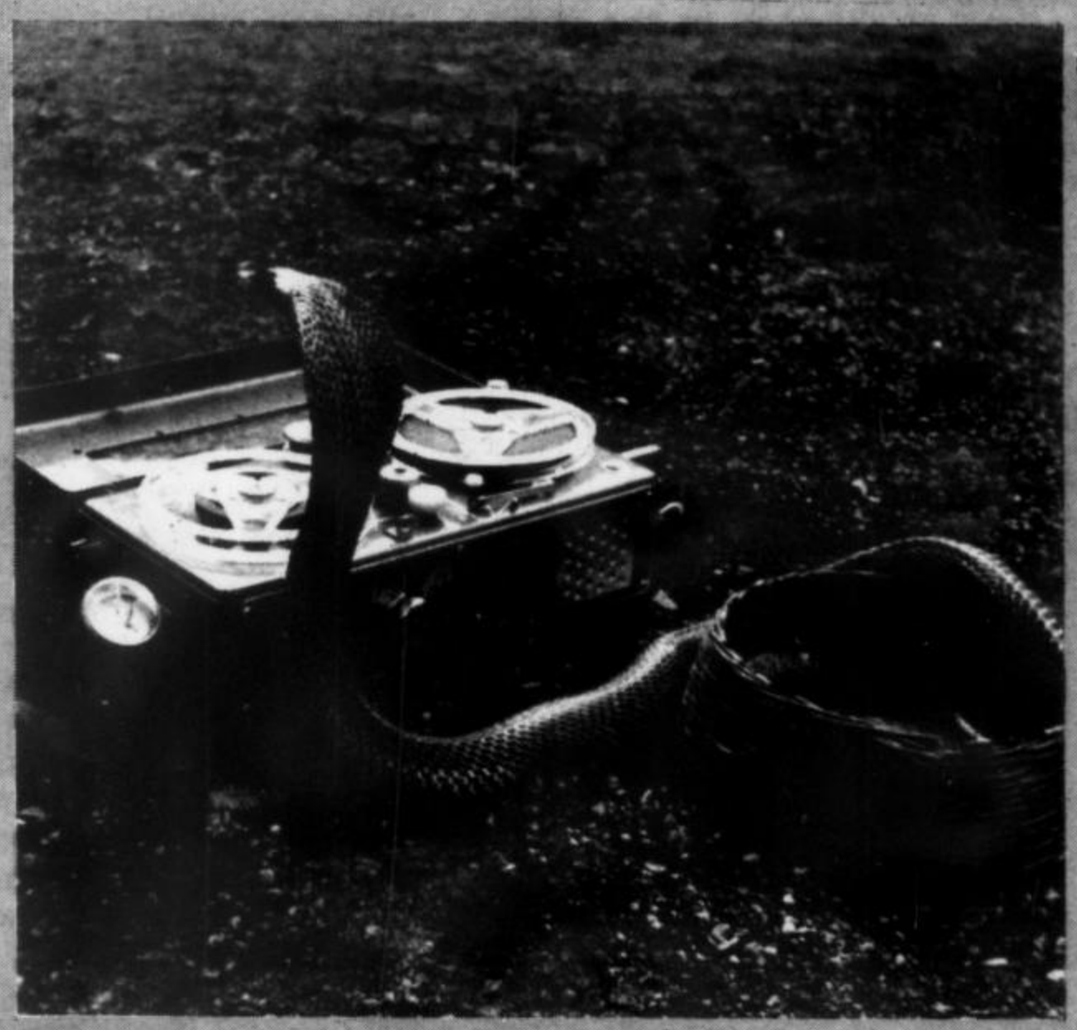
THE LIGHT PROGRAMME

by Siné

THE COBRA AND THE ELECTRONIC CHARMER

One of the most feared of all poisonous snakes is the cobra, the "hooded terror" of India, whose bite spells certain death. Each year these creatures are responsible for most of the 20,000 deaths caused by snake bites on the Indian sub-continent, and the bite of the king cobra has been known to kill an elephant in three hours. Yet despite all the dangers associated with it, the cobra is the favourite of snake charmers. A few simple notes played on the charmer's flute and the cobra rears itself up, its curious hood extended, and begins to sway in time to the music. Some people believe that snake charmers possess secret powers and that it is not the music that captivates the cobra but rather the charmer's motions with his flute. A recent experiment in India, however, showed that once a cobra is trained to dance to the music of a flute, it will do so even when the flute-playing charmer is replaced by an electronic instrument. A Swiss reporter-photographer, Pierre Pittet, recorded the flute-playing of a snake charmer and then played the recording in front of a cobra. As these photos show, the reptile immediately rose up and went into its dance... it was hearing "its master's voice".

Photos © Pierre André Pittet, Geneva



RADIO'S MAGIC EYE ON THE RIVER THAMES

by Martin Chisholm

© Camera Press, London

A great step forward in the movement that is going on all over the world to speed up the turn-round of shipping in the ports has been taken with the opening in recent weeks of a new radio information service at Gravesend, on the River Thames, the gateway to the Port of London. This service which has been designed to give shipmasters and pilots every piece of information that they may need about the state of the river at any hour of the day or night, and particularly in fog, has been made possible by the conclusion at the Hague in 1957 of the International Maritime Agreement on the allocation of V.H.F. frequency modulated wavebands.

Gateway to the port of London

The Thames, with one of the longest systems of docks and wharves in the world, traces a winding course of fifty miles from its seaward end to London Bridge which is the upper limit of navigation for practically all seagoing vessels. Gravesend, twenty-four miles up-river from the sea is a focal point for all shipping bound to or from the docks because it is here that vessels have to pass the customs and the port health authorities and it is here, too, that they pick up or put ashore their sea or river pilots. The channel at Gravesend is under half-a-mile wide and it has to carry a tremendous volume of shipping. As many as eighty vessels or more may pass through on a single tide.

For just over ten years the Port of London Authority, which controls the tidal sections of the river, had been using amplitude modulated radio equipment to give information to ships but, with the conclusion of the Hague agreement on V.H.F. frequencies a very much more efficient service giving better quality of speech together with freedom from noise and interference became possible and as a result the new Thames Navigation Service, which may well become a prototype for port radio services all over the world, was brought into being. Its facilities are available free to any ship equipped with even very simple V.H.F. radio equipment. This equipment is not limited in its uses to the Thames service; it can equally well be used with radio services already established or planned for ports in other countries, and, of course, it can be used, too, for direct speech between ship and ship at sea, and for public telephone correspondence ashore.

Panoramic view of all river traffic

The great advance that has been made in planning and equipping the Gravesend station is that facilities for the reception of information, for broadcasting it to ships and for a radar scan of some of the busiest and most important sectors of the river, are all housed in one very carefully designed operation room. Because the Trinity House pilots who take ships up the river to the docks or down it to the sea are as much concerned as the ships' captains themselves with the state of the channel and the traffic on it, the Navigation Service building has been

erected close alongside the pilot pier and there is direct access for pilots from their own rooms on the pier to a gallery in the operation room where they can study a panoramic plan of the whole river from London to the sea.

This panoramic plan occupies the whole of one wall of the operation room and below it is the radar scan which keeps watch over Gravesend reach at night and in fog. Eventually further radar scans will be installed so that thirty-one miles of the river can be kept constantly under watch.

The operation room is linked by telephone to the various docks from which programmes of the docking and undocking of ships are received. These programmes are noted alongside the river plan. Constant radio touch is kept, too, with the Port of London Authority's launches which report movements of shipping inwards and outwards and other essential information such as where vessels are anchored in the river, where dredgers are working, the position of wrecks, or where pile-driving operations are being carried out.

Robot 'watchdogs' of tide and visibility

All this information is noted on the illuminated river plan. The state of the tide is noted, too, as well as the degree of visibility at various points. Eventually data about tide and visibility which are at present received by telephone, will be automatically relayed by radio link from distant recording instruments which will keep it up to date from moment to moment.

Once in every half-hour, day and night, the duty officer working from the information on the plan prepares and broadcasts a short bulletin on the state of the river. For the remainder of the time the service is available at any minute to answer queries from any ship that calls it up. The caller makes contact on the international "calling and safety" channel and he is then directed to switch over to one of the four radio channels at present in use, two for the western and two for the eastern section of the river. Eventually the number of channels will be extended to three for each section.

A tanker, for instance, which is deeply laden, may want information that is accurate to within inches of the depth of water at one of the oil jetties lower down the river. The Gravesend radio service can give it within a few moments. Or, again, a steamer moving in poor visibility or at night, may pick up on its radar

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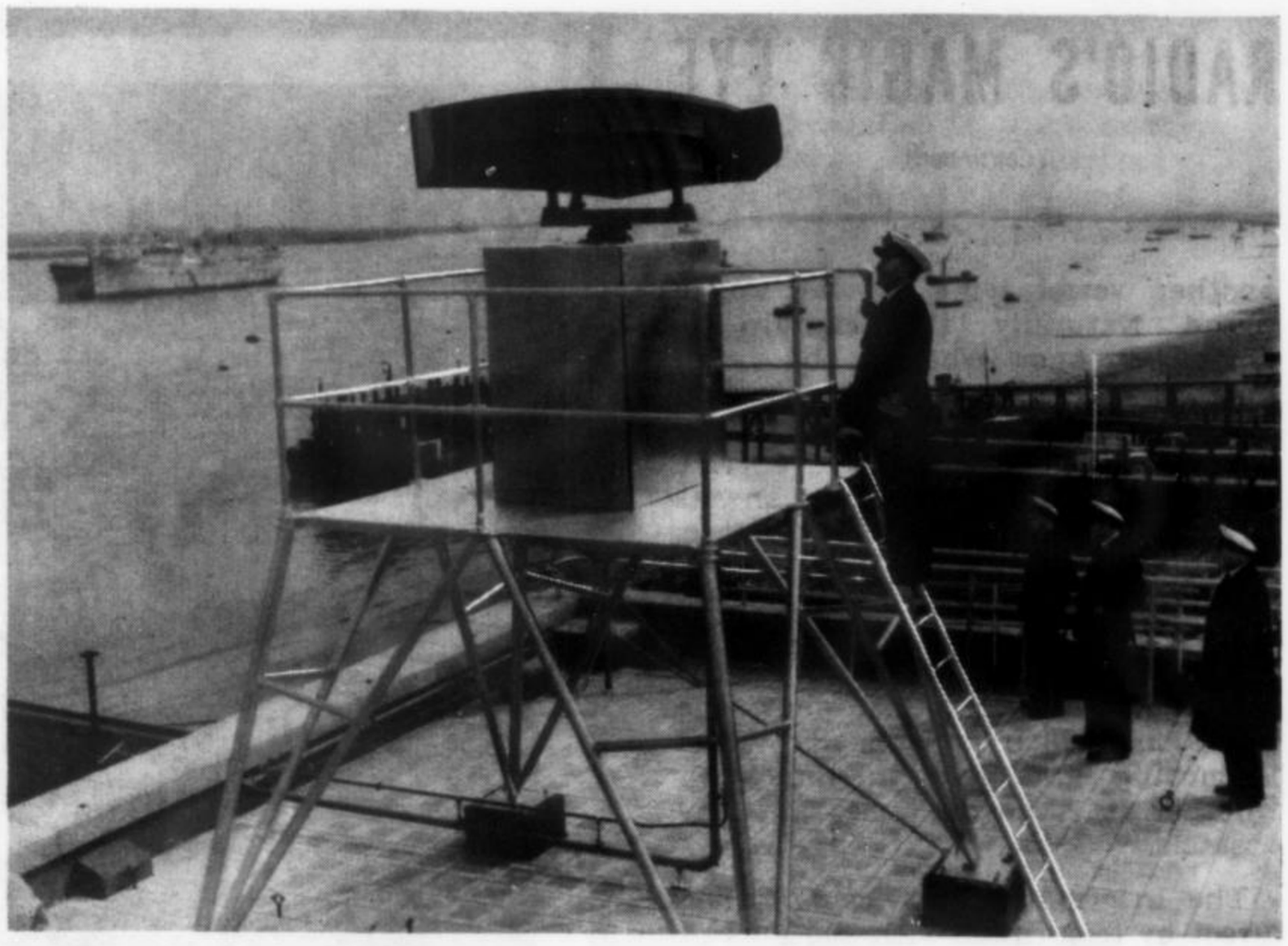


© A' Court Photographs, London

The port of London can boast a unique radio information service for shipping which may well become a prototype for port radio services all over the world. A special operations room has been built where movements of all traffic are plotted by radar (above) on a huge panoramic wall plan (left) of the whole river from London to the sea. Using VHF radio equipment, officers (below) flash vital information to all vessels on the Thames (opposite).

Photos © Fox Photos, London

RADIO'S MAGIC EYE

(Continued)

another vessel lying on its course ahead. Naturally the captain is anxious to know whether the vessel seen on his radar is moving or not, and he is anxious to know it quickly. He can call the Information Service and at once the radar scan at Gravesend picks up the two vessels and makes a check. Within a very short time the duty officer is able to tell the enquirer whether the ship he has spotted is moving or at anchor. The radar scan can also show the line along which a particular vessel is moving and give an indication whether it is heading clear of any obstacle.

The Information Service is linked direct by teleprinter with the Port of London's head office and movements of shipping are relayed immediately they occur. This is likely to result in making the publication of ship movements both simpler and quicker. Another function of the Service is to pass information at once to customs and port health authorities as well as to the pilots waiting to take vessels in and out.

Pioneering for better port radio services

It is perhaps here as much as in the giving of information to the ships themselves that the Service will help to speed up movement. On a busy tide there may be several ships awaiting clearance at the same time, with more following up astern of them. Anything that enables customs officers and port doctors, as well as the waiting tugmasters, to get on with their work smoothly and quickly is bound to assist in keeping all traffic on the move.

As yet the Thames Navigation Service is only at its beginnings. It has been planned for flexible development and very full statistics are being collected of the ways in which it is used. These will give a pointer to future modifications and extensions. In setting up this service the Port of London Authority is pioneering new ground and looking to the future. At the present time comparatively few ships out of the whole of the world's tonnage that uses the Thames are equipped with the necessary V.H.F. radio sets, but the expectation and the belief is that once the facilities that are available become more widely known installations will be made on a rapidly growing number of vessels belonging to many nations of the world.

Municipal Museum, The Hague.

Openbaar Kunstbezit.

Openbaar Kunstbezit.

THE MUSEUM INSIDE THE RECEIVER

Teyler Museum, Haarlem.

EVERY Monday after the evening meal, thousands of people in the Netherlands turn on the radio and go on a guided tour of some of the art masterpieces in their country's great museums. The guides on these broadcast tours are prominent art connoisseurs, museum directors or art historians who tell listeners about the origin of a particular work, the significance of its composition and beauty, about the artist who made it, its period of origin and so on.

Gathered around the radio, families (left) follow the talks with the aid of a reproduction of the work being presented. Well over 90,000 people joined the "art by radio" club last year. In return for a small fee subscribers receive in advance four reproductions of the works to be discussed every month—colour reproductions of paintings, reproductions in black and white of drawings, sculpture, graphic work and an occasional example of applied work.

Works are selected to offer characteristic examples of alternately old and contemporary artists such as Rembrandt's "The Return of the Prodigal Son" (below left) and "Portrait of the Artist's Wife" by Paul Citroen of the Netherlands (opposite page). Subscribers also receive texts of the broadcast commentaries and special binders which enable them to assemble at each year's end a personal collection of 40 reproductions and related texts.

This project, now a firm favourite on the Netherlands Radio network, was started by a group of art historians and artists who founded a non-profit organization called *Openbaar Kunstbezit* (Our Art Heritage) which arranges the broadcasts. This form of museum visiting at home has proved a real boon to many who are too old to travel, to the sick and those who live in isolated places. Subscriptions cover schools, sanatoria, hospitals (opposite page, below) youth welfare centres—and even prisons.

Members are also provided with a free pass giving them access to over 50 museums in the Netherlands. Museum attendance has risen by an estimated 50,000 to 60,000 since the broadcasts began, and for days after some broadcasts many people can be seen studying the original of the work of art presented over the air.

Through the letters it receives, the Foundation has regular confirmation that its work is opening the door to art and culture for many people. An 82-year-old listener recently wrote: "You do more than television, for besides the voice you give us the colours and the image is not gone when the programme ends. My album remains my treasured possession to which I turn again and again."

CENTRAL AFRICA'S 'SAUCEPAN SPECIAL'

by Peter Fraenkel

THE challenge to the Central African Broadcasting Station was immense and exciting: to bring education by radio to 7 million Africans. We were the first in Africa to try this and there were no precedents we could follow.

The station had had its beginnings in 1941, first at Kitwe, then at Lusaka, the capital of Northern Rhodesia. It then broadcast mainly war-news to the Africans of the territory. After the war its range was extended to Southern Rhodesia and Nyasaland and its broadcasts became primarily educational. It remained a government-run station until 1957 when it became part of the Federal Broadcasting Corporation of Rhodesia and Nyasaland.

The problems were many: for one, we had to use nine of the languages of the Rhodesias and Nyasaland—and even that left out large minorities.

But even more difficult was a problem that broadcasting stations in most other countries do not even have to think of: radio receivers.

At the end of the last war there were two or three hundred community receivers in welfare halls and mission-stations and at administrative centres, but hardly any Africans had sets of their own. These community receivers had not proved a success.

Our pioneer staff set out to try and have a set made that Africans could afford to have in their homes. The requirements were unusual: it had to be a short-wave set because only short waves can cover economically the immense area of the Rhodesias and Nyasaland—an area larger than that of the British Isles, France, all of Germany and Holland together (485,000 square miles). It had to be a battery set because few African houses have electricity. But above all it had to be cheap.

Such a set did not exist and it took the first director, Harry Franklin, three years to find a firm which could be persuaded to make one. In the end a company specializing in batteries agreed to produce one for him. It turned out to be a sturdy, round little set which looked like a saucepan on its side, and that is why they called it the "Saucepan Special". (The original "Saucepan Special" has now been replaced by another model of different shape.)

In 1948 twenty sample sets were flown out to Northern Rhodesia and within a few days they had been snapped up by Africans who paid £ 5 ($ 14) for the set and 25/- ($ 3.50) for the battery. The manufacturers sent their manager to investigate further and when he visited the new owners unexpectedly, he was met with such overwhelming enthusiasm that the company decided to go into mass production.

'I have the whole world in my hut'

THE sets were bought up faster than they could be manufactured and over the thatched huts of neglected villages and over the concrete-box houses of urban "compounds" aerials started to rise, dozens, hundreds, thousands and within a few years, tens of thousands.

Letters started to arrive at our broadcasting station in Lusaka in ever increasing numbers—some typed neatly, others scrawled painfully in one of the many vernaculars of the land.

"I have pleasure in telling you that ever since my life I have never had anything which could please my life better than the wireless I have got."

"Broadcasting is to Africans as the great invention of printing was to European countries in the Renaissance era... We are no longer isolated."

"Nowadays I will be enjoying a lot if I don't die quickly. I do enjoy very much listening to my set although I don't get satisfied (satiated) as I do when eating "nsima" (Maize meal porridge)."

"I feel proud when I switch on my Saucepan Special and have the whole world in my hut."

Before long the languages of Central Africa had been enriched by a new word—"wayaleshi"—the local way of pronouncing (the English word) "wireless".

We experimented with many types of programmes: There were discussion programmes in which the participants were a dozen or two "men in the street"—recorded in remote villages and urban beer-halls, on farms and in mines—some of them educated and sophisticated, others illiterate and traditionalist. There was a serial about a Copperbelt family, designed to let our audience identify itself with the hero who suffers the common experiences of recent migrants to the towns and solves his problems in an intelligent, modern way. There were radio refresher courses for rural teachers who are normally cut off from all mental stimulation.

Blind historians found a great new audience for the oral traditions of their tribes through our station. We persuaded shy, timid African women to discuss marriages and what could and did go wrong with them. Soon we were surprised to receive letters of comment from women, some from illiterates dictated to better-educated husbands. There was something stirring when the voiceless women of Central Africa came to write their opinions to broadcasters who were

not members of their family or clan, but total strangers.

We had many spectacular successes. But far more, we learnt from our failures. One of these we had with slogans.

Originally we had imagined that as broadcasting became less of a novelty our listeners would become more sophisticated. What we had left out of account was the increase in the number of listeners. As radio-ownership spread down the social pyramid the average standard of sophistication became lower. It all coincided with the increasing industrialization of the Rhodesias and the rapid increase in African incomes. Radio was becoming a "must"—a coveted symbol of status. We had to simplify and simplify still more.

That was when we decided to try slogans—hammering home a few simple lessons with repetitive little verses, not unlike advertising in commercial radio. Since ours was a public service station and carried no advertising, our audience had no experience of this approach—nor had we broadcasters.

For our first campaign we selected the advantages of education for girls and the dangers of the common house-fly.

I got together a team of helpers, among them an African author who was then working on a collection of proverbs in the Bemba language. I suggested that these might be useful. We might hook the new teaching-matter on to the known, traditional wisdom.

The others suggested we should use the traditional form, too. The chief or elder who uses a proverb never says the entire saying. He says one half, the other is added by the man he is speaking to. One says: "A garden does not grow by itself..." the other adds: "Unlike teeth in the mouth." (In other words, it needs effort.)

Theme and variations on a proverb-slogan

THIS was the pattern we decided to follow, having the second half chanted by a small chorus. Before many minutes had elapsed the five or six of us were scribbling away enthusiastically at possible proverb-slogan combinations. In the end we recorded a number, including the following. (The words in italics were spoken by a chorus of three.)

"Young trees: *they make the future forest.*

Let us educate little girls: *tomorrow they are the young mothers.*"

Another:

"Though it's small: *yet it's a heavy load.*

The fly: *though small, is dangerous.*

It gives us disease: *You, kill that fly!*"

We broadcast these and similar slogans for several weeks, then tried to assess their effect by interviewing listeners. Our interviewers chanted the first half and then—wherever they went—the remaining words were supplied word-perfect. But only very few listeners understood what we were trying to get at.

The better-educated townsfolk knew all about the need for female education and about the dangers of the common housefly.

"You are quite right", said one, "there are many reasons why women should be educated. They are like the front wheel of a bicycle and the one behind are the men. As a bicycle cannot run with one wheel, so we men cannot raise the country lonely."

However, these new townsmen—in most cases only a decade or two out of their villages—were completely bewildered by the proverbs. First they ignored them, but when the interviewers pressed them they tried to interpret them literally.

In remote villages we found the opposite reaction. The proverbs were known and commented on at length, but these villagers saw no connexion between them and our new lessons.

Yet all those interviewed had been regular listeners. Since these slogans were designed largely for the illiterate townsmen who might become listeners if incomes continued to rise, we decided to extend the enquiry.

We brought groups of such potential listeners into our studios, played them recordings of the slogans and tried to get their reactions. It took a long time to overcome their suspicions, but when at long last their reactions came, they were even more startling. There were many different reactions, but they all had one thing in common: they were deeply allegorical. Nothing was ever interpreted literally:

"You speak wisely," said one; "though small, yet it's a heavy load. The fly is small, but it brings disease. It's like this: One man can spoil the happiness of an entire village. He may be a witch. He brings fear and hatred and suspicion among the people. He may even give the chief an illness by his witchcraft. "Kill that fly" means we should send such a man out of the village. One such man can spoil an entire village. Though it's small, yet it's a heavy load."

There was much that we had to learn the hard way... by trial and error!

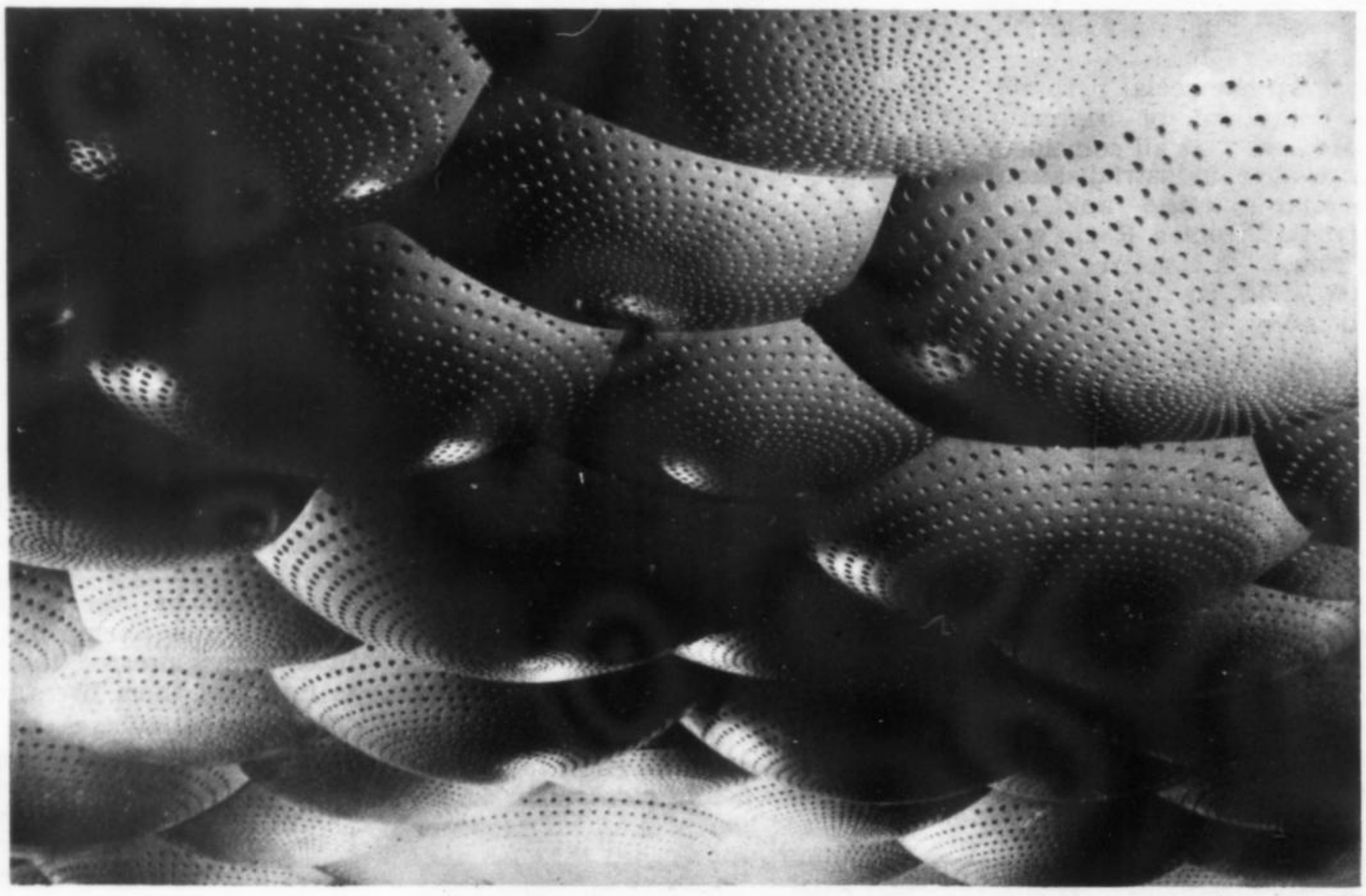
Northern Rhodesia Information Service

A STURDY LITTLE SET, the "Saucepan Special", helps to bring education by radio to seven million people in Rhodesia and Nyasaland. Since the first of these low-priced battery sets was put on the market in 1948, tens of thousands of aerials have risen above thatched hut villages and concrete houses of urban compounds. For the people of the two territories radio has become a "must". "Broadcasting is to Africans as the great invention of printing was to European countries... we are no longer isolated", wrote one listener to the Central African Broadcasting Station in Lusaka. Broadcasts go out in nine languages and listeners themselves take part in discussion programmes. The original "Saucepan" model shown here has been improved and has a different shape.

Peter Fraenkel, who has long been associated with the Central African Broadcasting Station, is the author of "Wayaleshi," a newly-published book devoted to the work of this radio station at Lusaka. (Publisher: Weidenfeld & Nicolson, London; price: 21/-.)

A LITTLE LESS NOISE, PLEASE

by M. H. Thompson



Louis Joyex-RTF

GIANT 'GOLF BALLS' studding the ceiling of a French broadcasting studio are one of the many kinds of sound absorbing materials used nowadays in acoustics. Cheap and easy to apply, they range from stone-like tile with the appearance of travertine marble, to wood fibre tile punched full of holes and blankets of absorbent mineral wool rolled in long strips. Opposite page, general view of same studio ceiling.

To hear or not to hear... That is the problem.

Haven't you heard people say they couldn't hear a lecture well because the acoustics were so bad? These people wanted to hear. On the other hand, haven't you heard people say they couldn't sleep a wink all night because some noise kept them awake? (Maybe it was only a cat rubbing his whiskers.) At any rate, these people didn't want to hear. Music from the Hi Fi is wanted while, at the same time, traffic noise is not.

Furthermore, loud noises that constantly assault our hearing organs produce fatigue, while certain other sounds are pleasant without our realizing just why. Physiologically the ear is built to take only so much noise. Nature's sounds are usually muted—the ripple of a brook, the song of a bird, the mooing of a cow. Civilization's are often the opposite—the wail of a siren, the din of traffic, the roar of aeroplanes in the sky. There are other reasons too why we would preserve one sound and suppress another. Hi Fi, for example, can be merely high finance unless the high fidelity sounds are truly heard, which they cannot be in many noisy rooms. The problem then is to hear or not to hear, and involves a knowledge of the laws of sound or the science of acoustics.

Ancient Greeks studied acoustics but a Frenchman coined the name

The word *acoustics* is from the Greek and means "to hear". Ancient Greeks were aware that sound somehow arises from the motion of parts of bodies and is transmitted by the air through some undefined motion of the air and in this way, striking the eardrums, produces the sensation of hearing. Aristotle emphasized that in hearing actual motion of the air is involved. Pythagoras in the 6th century B.C. studied the origin of musical sounds and discovered that of two stretched strings fastened at the ends the higher note is emitted by the shorter string and that if one has twice the length of the other the shorter will emit a note an octave above the other.

Joseph Sauveur, who pioneered in the study of sound in the early 18th century, first used the name "acoustics" for the science of sound. Today the word means the properties of a room which make it conducive to ready and faithful transmission of sound. Also, as to present-day nomenclature, acoustic refers to things distinctly related to the functions of sound, such as acoustic absorption, acoustic response, and acoustic spectrum (the range of frequencies or wave lengths that are audible). "Acoustical" refers to associated things, such as acoustical tile, treatment, engineers, instruments.

In the 19th century more work was done in the science of acoustics. Lord Rayleigh learned something about how sound is propagated, its speed in various mediums, such as air and fluids and solids, and the determination of pitch and its dependence upon frequency of vibration. But even with his research, and that of Sauveur and a few other men, acoustics remained a little known science until after 1895.

Up until then a room with good acoustics was more or less an accident. When such a room or auditorium was found, architects copied the design to try to get another room or auditorium with equally good acoustics. Sometimes they succeeded and sometimes they didn't. But about this time there lived a man who was a member of the Harvard University physics faculty, and he became interested in the science of acoustics and began to study more about sound absorption.

The new Fogg Auditorium of the University of that time

had been copied after the Sanders Theatre in Boston, which had very good acoustics. But in spite of that the Fogg Hall was a failure acoustically. So this physics professor, W. C. Sabine by name, undertook to learn what had gone wrong. He learned that the Fogg Hall hadn't supplied seat cushions and when this was done the acoustics were almost perfect. But his search and research didn't end there.

As he learned more about the laws of sound, he began to establish standards of measurements and units of acoustic energy. He finally established a unit, later called a "sabin" after his own name in recognition of his work. It is the amount of sound energy lost to a room through one square foot of open space such as an open window. The energy is minute. It takes the combined power of about fifteen million voices to equal one horse-power, a unit of work equal to 550 foot-pounds per second.

In time Sabine found that the easiest way to work with sound energy was to convert it to electrical energy, where units and procedures of measurement were already well established. This changed acoustics from the realm of architecture to electrical engineering. But until the invention of the vacuum tube just before World War I minute values of electricity were extremely difficult to handle or measure, and only the amplification of these minute energies to measurable amounts made the study of sound possible in all its phases.

Briefly expressing sound power in the electrical unit of the watt, and remembering that the average light bulb takes 100 watts of energy, we find that the human voice at conversational levels equals .002 watts, the clarinet .05, the trumpet .3, and the bass drum 25 watts of sound power. While the sound power of energy is minute, yet so enormous is the range of the human ear that the ratio between the intensity of the least noise we can hear—a baby's breath, for instance—and the greatest sound intensity we can stand without pain or injury, is one thousand million to one.

Naturally such ratios would require long strings of zeros in any calculation relating to sound, so the physicist and the acoustical engineer use a sort of mathematical shorthand, employing the logarithmic unit of the decibel.

Much of the science of sound cannot be explained easily to the average person. Information is buried in technical journals of limited circulation or in textbooks so technical that they serve only the acoustical engineer or the advanced student of physics.

Confused noises bounced from the walls, floor and ceiling

But the average person can understand something about acoustics by comparisons. Most of us know that we hear best in a quiet location out of doors. Here voice or music is heard in natural beauty. This is true because outdoor sound can travel freely in all directions, unconfused by echoic repetition of sounds previously uttered. In an enclosed space, however, the walls, floor and ceiling do not absorb the sound as do the grass and shrubbery and open sky of a quiet location outside. Sound is reflected back to mingle in confused noise.

In fact, at a distance of more than a few feet we hear not so much by the direct sound from the source as by the sound reflected from room surfaces. And at the rear of some auditoriums the reflected sound may be nine-tenths of the total reaching the listener. In its many reflections en route the sound is changed in quality by having more of some tones than of others removed or absorbed by the reflecting surfaces. Thus sound plays in our daily lives a part scarcely less important than motion and light, and rooms present acoustical problems.

And the problems of suppressing unwanted sounds without altering the quality of the wanted sounds are scientific problems. For each room of known intended use there is a correct amount of acoustic absorption at each pitch of sound, which absorption will suppress unwanted echoes while at the same time preserving without distortion the maximum of wanted sound. The difference between this correct amount of absorption at each frequency and that already existing in the room itself—its boundaries and furniture and occupants—is the amount that must be supplied by the acoustical treatment.

To suppress an unwanted sound wave—make it work

For each occupied room there is a correct distribution of the total acoustic absorption in the vertical, transverse, and longitudinal directions. It is essential that absorption and reflection shall be so distributed as to diffuse the sound as well as to absorb some of it. Calculation of these factors for the room on the drawing board requires some mathematics and much reference to graphs and tables already in existence, and often involves the construction of a scale model. Precision instruments and acquired skill are also used. If the room turns out to provide maximum distribution of undistorted voice or music with a minimum of unwanted echo, that room is said to have good acoustics. Perhaps more accurately we would call it a quiet room, a room free from unwanted sound.

Not only are new buildings constructed to the laws of acoustics but old buildings are worked over at the advice of acoustical engineers to eliminate noise. For instance, many auditoriums built twenty-five years or more ago have echoes so intense that an ordinary voice on the stage can't be understood more than half way back; and there are places where the echoes from the back wall cancel out the voice from the stage and make music sound quite unnatural.

Thus buildings, both old and new, are acquiring better acoustics by both sound proofing and sound conditioning. True sound proofing is keeping sound out; sound conditioning is absorbing sound that is already in. The first requires mass, thickness and weight of the barriers; the latter requires light porous material such as acoustical tiles and boards.

In fact, noise control is possible because of the development of cheap and easily applied absorbent materials, and these are of great variety, ranging from stone-like tile with the appearance of travertine marble, through wood-fibre tile punched full of holes, to blankets of absorbent mineral wool rolled in long strips. The materials are all indexed as to sound absorption at each of six octaves of the piano keyboard, flame resistance, light reflection, and weight per square foot.

Certainly there is plenty of choice but the very plethora of available materials makes a proper choice more imperative. Moreover, the cost per square foot may range from 25 cents to $1.50, which also makes choice—the wrong one—expensive. So it is up to the acoustical engineer to advise about the product too.

CONTINUED ON NEXT PAGE

LESS NOISE, PLEASE
(Continued)

The drum: 500 times more power than the clarinet

Scientifically, by the use of acoustical absorbent materials, the energy in the sound wave is changed into some form of *work done* so that the energy is no longer apprehended as sound. For instance, in fibrous materials the filaments making up the tile or board are set in motion by the sound waves and the energy required to make them move is *work done*. Hence this is energy lost to the sound wave. Or movement of the fibres may cause friction which is dissipated as heat and again the energy has been converted into something else and is no longer sound.

Because there are so many different types of sound-absorbing materials, all good, and so many ways of applying them, and because they vary from type to type in the amount of sound they absorb at different frequencies (pitch) of sound, great care is necessary in choosing the right material and its method of mounting for the particular room, or occupancy, or expected sound levels encountered.

Too much proofing leaves the room hollow & boomy

For example, suppose a room is being designed for orchestra practice. The instructor must be able to hear each instrument as a separate sound source if he is to correct mistakes of each player. Expressing the sound power in the electrical unit of the watt, the drum would release 12,600 times as much power into the room as the human voice, and 80 times the power of the trumpet and 500 times the power of the clarinet. Usually the notes of the clarinet are several octaves above the drum.

Whatever acoustical material is applied in the room must of necessity give a lot of absorption at the low frequencies of the drum if its enormous power is not to drown out the higher pitches entirely. Since most acoustical tile of the sort usually applied in stores and offices is six to ten times as absorbent at high frequencies as at low ones, they must be ruled out of this particular job.

And not only is the selection of the kind of material important but the placing of the material is just as important. Also, the exact quantity of material is *necessary* too. If too much treatment is applied, usually the echoes are gone, that's true, but the remaining sound is often badly distorted as to pitch, for most materials reduce the high pitched sounds far better than the low ones, so that what is left for us to hear is the low pitched tones, and the room then sounds hollow and boomy.

False ceiling cures the problem of three orchestras in one

Thus each job has its own special problems for the acoustical engineer to solve. It may be interesting to know how one acoustical engineer solved the problem of noise in one auditorium. This public auditorium was built years ago. The room was 110 feet by 70 feet with a ceiling only 20 feet high, and the stage on the long side.

The echoes were so intense that an ordinary voice on the stage couldn't be understood more than half way back, there were three rows in the middle where the echo from the back wall cancelled out the voice from the stage, and the only expedient had been to put so much power behind a loud speaker that the resultant roar, while annoying in the extreme, did force enough clear sound out over the floor that speech was at least partly intelligible. But a dance band generated so much echo that in the corners one could hear double and triple beats. Some bands wouldn't play in the hall, so an acoustical engineer was called in to solve the problems.

With electrical instruments he made exhaustive measurements of the sound and echoes, explored the hidden structure of the walls and ceiling, and contrary to the procedure followed in 99 % of such problems, specified a ceiling hung 17 1/2 inches below the original one, in an aluminium gridwork of channels, and put into the grid sheets of Fibreglas 2' × 4' in symetrical patches that totalled less than one-third of the ceiling. He filled in the rest of the area with sheets of sheetrock the same size as the fibreglas, then had the whole ceiling painted.

SOUNDING OFF BEHIND THE MIKE

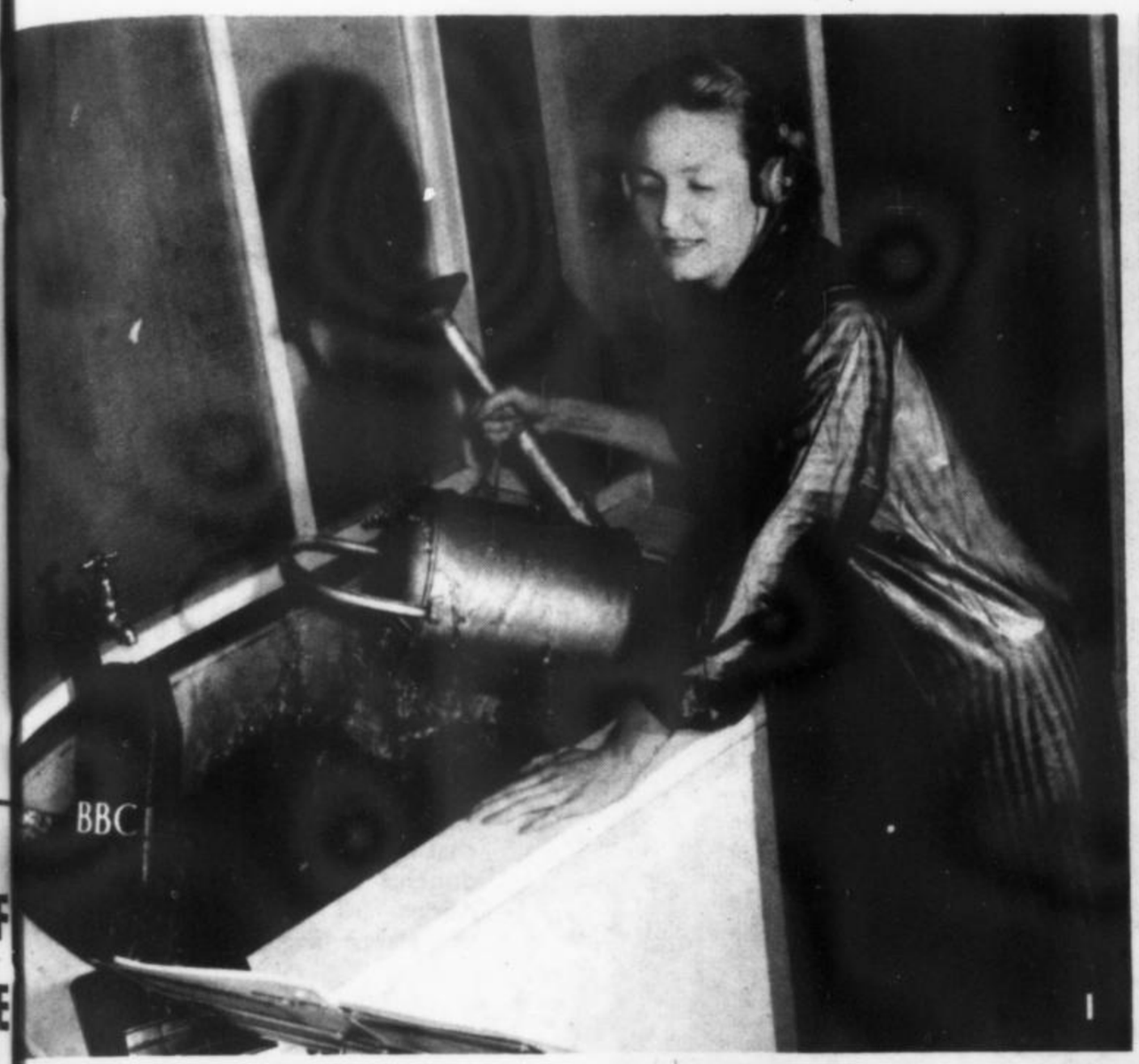
Few background noises are the real thing on radio. A crackling fire may be only cellophane being crumpled, something moving in the bushes merely twisted straw, a body blow a fist punching a rubber sponge. Sound effects can imitate almost any noise, but nothing can duplicate the sound of water except water itself. Photos show (1) diving and splashing effects; (2) staircase, half stone half wood, used for effects. Staff is shown how not to fall down stairs; (3) submarine commander (rear) shouts instructions while actors lie on floor to give right acoustics for scene taking place in dinghy at sea; (4) effects men imitate creaking of ship's rigging during storm at sea and breaking up of the mainmast while woman in background plays effects records of howling winds and raging seas; (5) a duel... with electronic firearms! Two actors fire the "guns" but the shots come from the two little grey boxes being adjusted by effects woman; (6) agile feet and hands are needed to start right sound effects recordings listed under "train", "cheers", "drums".

All photos © BBC, London.

Also on the walls, in several selected areas that were reflecting the measured echoes, he glued large panels of fibreglas, 3/4" thick to absorb the sound. Now in the auditorium, a listener can understand a low voice on the stage at any place in the room provided the audience is between 200 and 1,000 people. And dance bands that have played there before and after treatment call it "wonderful."

Sound control does not apply to auditoriums only. Corrections extend to commercial buildings too. As the world became noisier the problem of sound control began to apply in factories, in office rooms, and in busy public places. Machinery has contributed to much of this noise, including many typewriters in one room, or addressographs, for instance. The human voice has done its share to make places noisy too. It has been ascertained that noise made at a restaurant by 250 women having lunch registered 75 decibels. Sound engineers have looked into the household too and what they have found in the way of noise is startling. In the ordinary house, radio, TV sets, defective refrigerator motors, vacuum cleaners and the like produce much unwanted sound.

CONTINUED ON PAGE 32



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The range of waves known as the electromagnetic spectrum is like a long piano keyboard. The string struck by each white key vibrates at half the rate of the string eight notes higher, so that for each octave, frequency doubles and wave length halves. About 50 octaves represent the electromagnetic spectrum.

COI, London

No doubt more and more in the future truly acoustical architecture will be applied even to homes, especially to those in the higher cost brackets, so that annoying noises can be kept to a minimum. And perhaps some acoustical engineer will devise some inexpensive gadgets that could be mailed to home owners with instructions for use in rooms much as the engineer uses equipment on his jobs.

Then a consulting-by-mail business could be built up to help people with their problems of noise control. The home owner could draw a rough plan of the room, its furnishings, and give the number of people usually occupying it, etc. He would report the results of the simple tests taken with the gadgets, and a suitable treatment could be recommended for a modest fee at probably far less cost than the usual risky allover-ceiling coverage so often used.

Acoustics are for 'do it yourself' amateurs

UNTIL then, however, people who can't afford acoustically engineered rooms can learn lessons from the facts now known about the laws of sound to help keep down noise.

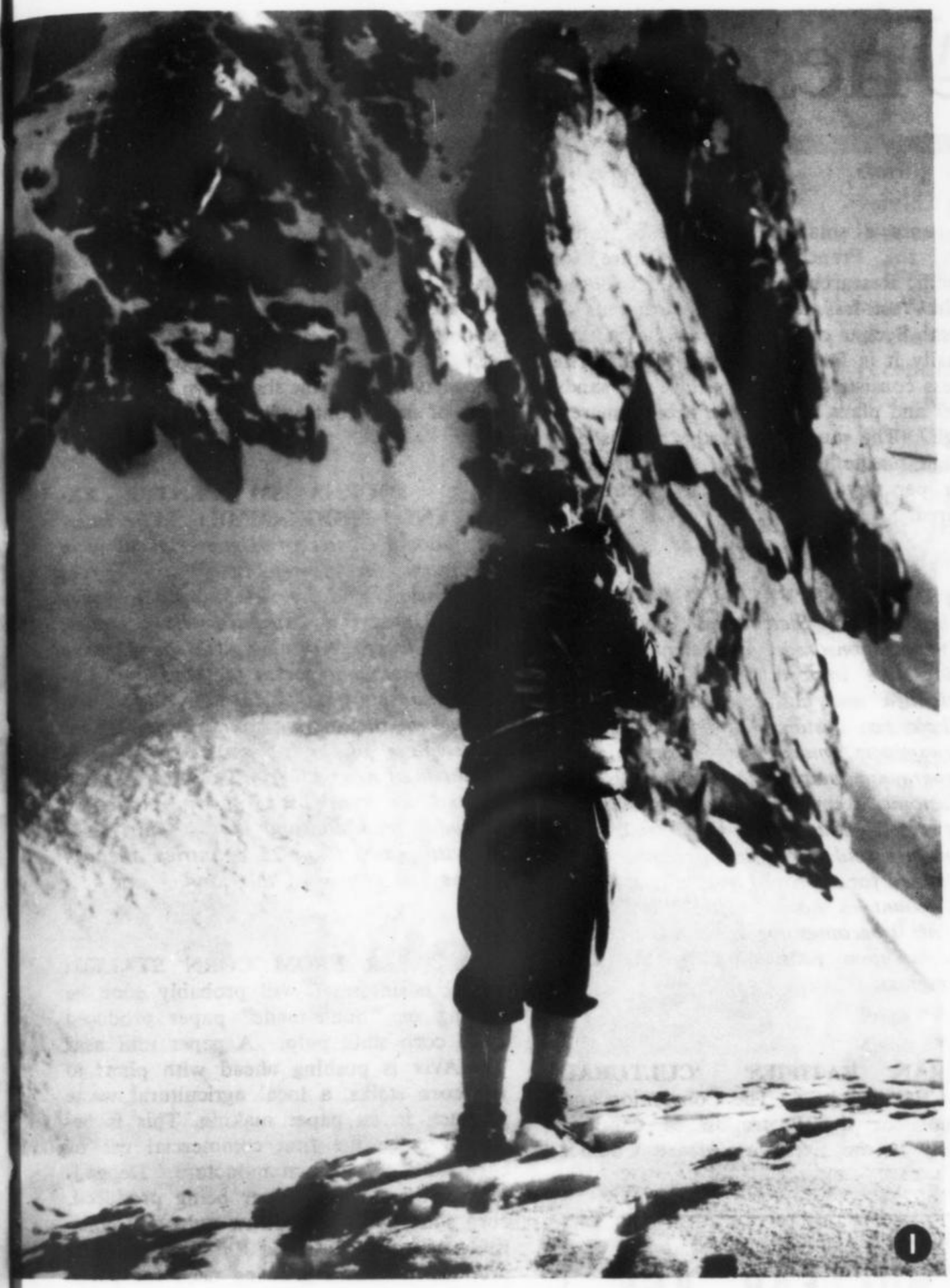
A basic principle in reducing noise is to attack it at its source. If the kitchen is the noisiest place, then an entire ceiling of acoustical tile will accomplish as much as a 40 per cent reduction of noise, thus vastly reducing the amount available for transmission to other areas of the house. The next step is to make a sound trap between noisy areas such as the kitchen or rumpus room and the bedrooms or study where quiet is wanted. This can often be accomplished by covering the ceiling and upper two feet of the walls of a connecting hallway with acoustical material.

In the living room a complete ceiling of acoustical tile or other material would kill or distort the quality of music from the radio and TV. Here acoustical "damping" of sound must be obtained on two walls that intersect each other—not on walls opposite each other. In fact, the main causes of poor hearing conditions in such rooms are parallel wall surfaces of plaster or plywood. So acoustical material could be used on adjoining walls, not parallel, to cut down noise. Or if one can't afford acoustical material, if one wall has heavy lined window drapes, one can experiment with a heavy wool blanket on the adjoining wall. A tapestry can be hung over the blanket. But home owners who think a mere ceiling of acoustical tile will solve their problem are more often disappointed than pleased, for they usually ruin it so far as hearing phonograph or radio music is concerned.

There are a few more pertinent facts about cutting down noise in the home. If the telephone bell bothers you, you might try cutting a little square of sponge rubber to fit underneath it. The same trick will work for a radio or TV set or a noisy typewriter. A pad of sponge rubber under them will keep the sound from traveling down the table and along the floor. However, it won't affect the sound that comes out of the speaker. Radios and phonographs should be set in *a corner* for best sound. A sponge rubber rug under a carpet will cut down the noise of clattering feet. Rugs themselves, as well as pads under them, are a help in this respect.

In fact, the ancients used rugs, draperies, and pillows to cut down noise. They didn't know why, but a lot of the trouble comes when sound bounces about the room. The noise hits a hard surface and flies off in a different direction. Any type of soft covering that will absorb this extra sound will make a big difference in personal comfort. Curtains or drapes around the windows help. Weather stripping on doors and windows help keep out traffic noise. Shrubbery or a row of trees on the outside will help too. Windows facing the street should be double weight or plate glass to cut down noise. Double thick ceiling plaster will cut out the noise of aeroplanes three times better than rock wool heat insulation would do.

A little common sense, too, can protect your hearing from jarring noises. Keep the radio tuned down, also the TV. Wear ear plugs (made especially for noise) if construction or other loud continuous noise is going on near you. Anyone can have some extra pillow around to help absorb noise. For noise, according to the dictionary, is unwanted sound and quiet is freedom from noise. And nowadays "Quiet Please" can mean a lot more than telling someone not to make noise. It can include the whole gamut of acoustical data in all its scientific phases.



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MIGHTY HANDY THAT WALKIE-TALKIE

As equipment becomes more compact and yet more powerful the vast possibilities of radio are being exploited in innumerable ways. Photos here show farmers, film-makers, explorers and railwaymen using radio to make their work easier, safer and more efficient. (1) French film-maker uses "walkie-talkie" transmitter-receiver while shooting a mountain-climbing documentary on some of the most difficult and dangerous French Alpine peaks. (2) French explorers observing the giant lizard of Komodo (largest of the lizard tribe; sometimes 12 feet long) in Borneo, communicate with colleagues in other hidden observation posts. (3) Russian farmer reports back on progress made with harvesting. (4) Railwayman in the United States uses two-way portable radio to give instructions to other crew members of a long goods train.

(1) Production Filmartic-Marcel Ichac
(2) Thomson-Houston
(3) Official Soviet photo
(4) USIS

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From the Unesco Newsroom...

FROM PRINT TO BRAILLE BY COMPUTER : Exciting new prospects for blind readers are being opened up by one of the latest applications of electronic computers. With the aid of one of these machines, a 300-page book can now be translated into Braille in one hour—a task which would take almost a week for several skilled translators to complete. It takes about two years to train specialists of Braille whereas the new method does not require a knowledge of Braille on the part of the operator. The machine translates 4,000 words a minute.

■ **BUDDHIST ART IN JAPAN :** *A new album - "Japan: Ancient Buddhist Paintings" - has just been published in the* UNESCO *World Art Series which offers high-quality colour reproductions of works not previously well-known outside their own countries. Devoted to works painted between the 8th and 12th centuries, the album offers an impressive overall view of Japanese Buddhist art which runs from mystical images to realistic portaits. The album is published by the New York Graphic Society, Price :* $ 18 ; £ 6 7. *O.* ; 8,850 *Fr. Frs.*

SAHARA SOIL-LESS FARMING : Tomatoes, cabbages, radishes, lettuce, maize and groundnuts can be grown in desert sand without any special shelter and with only a small quantity of irrigation water, the French National Centre for Scientific Research has just revealed following its "soil-less farming" experiments at Colomb-Bechar on the edge of the Sahara. Actually it is farming without humus. The process consists of placing a layer of sandy gravel and plant nutrients in a big concrete trough. The sand is regularly "nourished" through plastic tubes. Only three litres of water per day and per square metre are required.

■ **U.S. SIGNS 'FREE FLOW' PACT :** *The United States has signed the* UNESCO*-sponsored Agreement on the duty free importation of educational, scientific and cultural materials which eliminates customs duties on books, newspapers, magazines, works of art, geographic maps and musical scores. Customs exemption is also granted to newsreels, educational films, sound recordings and scientific apparatus when destined for approved institutions. So far* 31 *countries have ratified the Agreement; it becomes operative in the United States upon ratification by the U.S. Congress.*

IRAN RATIFIES' 'CULTURAL RED CROSS' PACT : The Convention and Protocol for the Protection of Cultural Property in the Event of Armed Conflict was recently ratified by Iran, the 29th country to do so. The Convention was adopted in 1954 by a conference convened under Unesco's auspices. Under its terms, nations undertake in the event of armed conflict to safeguard as well as to respect cultural property located on their own territory or that of other contracting parties.

■ **JOURNALISM CENTRE EXPANDS PROGRAMME :** *The International Centre of Higher Education in Journalism created two years ago at Strasbourg University on the initiative of* UNESCO *is expanding its activities, and from December will be offering six-month courses in methods of teaching journalism. Until now it has run a one month training course each year for teachers of journalism, covering methods of newsgathering and presentation, and the journalist's role in relation to radio, television and film. Thirty-four participants from* 25 *countries attended the last course of this kind.*

PAPER FROM CORN STALKS : Israeli businessmen will probably soon be writing on "home-made" paper produced from corn stalk pulp. A paper mill near Tel Aviv is pushing ahead with plans to use corn stalks, a local agricultural waste product, in its paper making. This is believed to be the first commercial use of corn stalks in paper manufacture. Depending on the kind of paper being produced, corn stalk and cereal straw pulp will constitute between 20 % and 100 % of the final product. Israel's growing need for paper is reflected in the fact that it now ranks third in the world in the per capita publishing of books.

■ **SCIENCE-MINDED JAPANESE :** *In Japan the number of young people studying science and technology is increasing far more rapidly than the number of students taking arts degrees, reports the International Bureau of Education in a recent survey. Last year, out of every fourteen Japanese students, nine were studying science and only five literature, as compared with* 1957 *when the proportion was exactly the reverse.*

EDUCATION FOR THE NUCLEAR AGE

THE pressing educational problem of training technical and scientific personnel for the world's ever-expanding industrial and technological installations and in particular for the development of peaceful uses of atomic energy was discussed recently at two important international conferences convened by Unesco jointly with other organizations.

This year's annual Unesco-International Bureau of Education Conference at Geneva discussed aspects of the training of technical and scientific personnel: financial, administrative, educational, as well as social. These included the use of funds for training, long-term planning to put an end to the shortage of qualified personnel, increasing the number of technical training institutions, and the study of social measures—fellowships, housing, employment offices—likely to stimulate the recruitment of future candidates. Delegates studied a survey of these problems in 50 countries and drew up a recommendation to Ministries of Education designed to promote bigger training programmes.

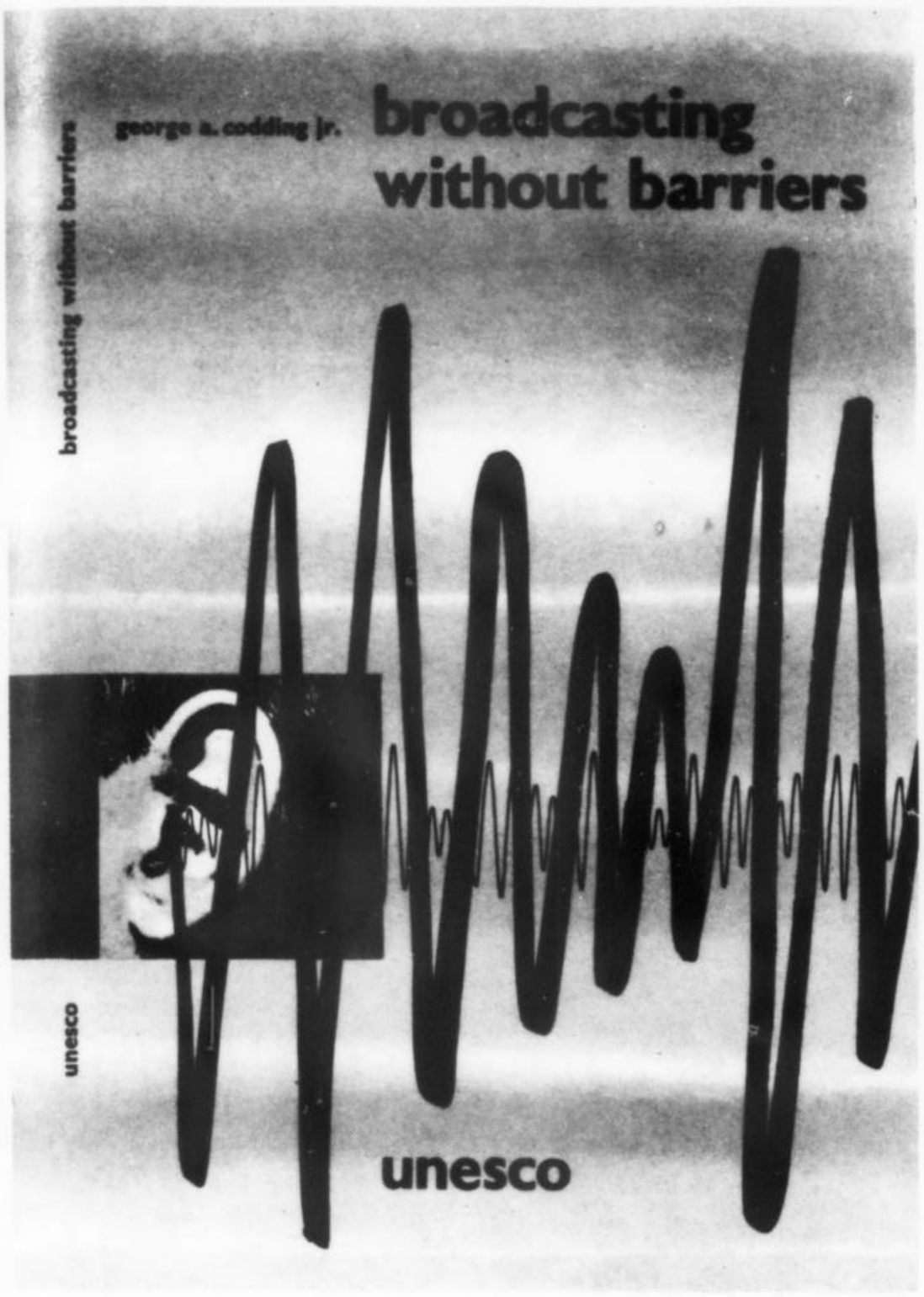
A the French Centre for Nuclear Research at Saclay, near Paris, scientists from 30 countries discussed educational problems specifically concerned with the development of atoms for peace. In technically advanced countries there is a lack of trained manpower to meet the needs of rapid nuclear development, both in nuclear science technology and in the operational phases of atomic energy. Delegates discussed the role of universities, engineering colleges, nuclear research centres and international organizations in the education of nuclear personnel. Special attention was given to the need to train more health physicists and to introduce nuclear science at the secondary school level.

★

MIRACLE AT ROTTERDAM

We apologize to readers for an error made in the last issue. The caption on pages 18/19 identified the sculpture in the centre photo as the work of Anne Grimalden of the Netherlands. This sculpture is the work of the Norwegian artist, Anne Grimdalen, and was a gift from Norway to the city of Rotterdam.

Imp. GEORGES LANG, PARIS. IMPRIMÉ EN FRANCE.



Just published

Unsurpassed in speed, range and economy, radio broadcasting is an ideal means of informing and entertaining the world's peoples and promoting the free flow of ideas between countries. But many obstacles impede its effective use.

The development of broadcasting in various regions has been extremely disparate, with the result that 60 per cent of the world population still lacks adequate transmitting and reception services. Broadcasting organizations and industries have not always kept pace with technical advances, with the changing requirements of public interest, or with the challenge of the new medium, television. Insufficient effort has been made to promote the international exchange of programmes. And finally, failure to agree on the rational use of frequencies for broadcasting has hindered expansion in the advanced as well as the less advanced countries.

These problems are examined, and solutions suggested in this study, which is an indispensable aid to everyone interrested in the progress of broadcasting, nationally and internationally. It contains pictographs, photographs and an extensive bibliography. A Unesco publication; obtainable from Unesco's Sales Agents, see below.

Price : Paper : $ 3.00 ; 15/- (stg.) ; 1,050 FF.
Cloth : $ 4.50 ; 22/6 (stg.) ; 1,600 FF.

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BELGIUM. — For The Unesco Courier: Louis de Lannoy, 22, Place De Brouckère, Brussels, C.C.P. 338.000. (fr.b. 100.) Other publications: Office de Publicité, 16, rue Marcq, Bruxelles, CCP 285-98; N.V. Standaard-Boekhandel, Belgiëlei 151, Antwerp.

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Payot, 40 rue du Marché, Geneva. CCP. 1-236. (fr. s. 6.50.)

THAILAND. — Suksapan Panit, Mansion 9, Rajdamnern Avenue, Bangkok.

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OPERATION POCKET RADIO

Recent air disasters have shown how difficult it is for rescue services to locate survivors, especially when the aircraft has come down in the sea. They have also highlighted the work of rescue services in many parts of the world and new efforts to improve techniques and devices for locating and rescuing victims of shipwreck or aircraft crashes.

Typical of such research is Operation "Porpoise" carried out in the Mediterranean by the French Search and Rescue Service to test equipment used by survivors of an imaginary transport plane making a forced landing in the sea.

Thirty volunteer "survivors" were put into two aircraft dinghies somewhere between the French coast and Corsica and as soon as the alarm was given three aircraft took off to search for them. The survivors made use of medium radio transmitter-receivers then in current use and also a new Ultra-High-Frequency apparatus operating on short waves and shown in the photos on this page taken during Operation "Porpoise". Five hours after the theoretical forced landing, the dinghies were located by a radio-fix from the searching aircraft.

The tiny Ultra-High-Frequency transmitter-receiver, which gave convincing proof of its effectiveness, weighs only 1 lb. and can be held in the hand. It works on transistor batteries and its transmitting range despite its size and short two foot aerial, is 100 kms. Unlike older equipment, the new transistor sets require no cranking of generators and are instantly ready for use even by physically exhausted victims.

Photos Thomson-Houston